Relative Valuation

Aswath Damodaran

Why relative valuation?

"If you think I'm crazy, you should see the guy who lives across the hall"

Jerry Seinfeld talking about Kramer in a Seinfeld episode

" A little inaccuracy sometimes saves tons of explanation"

H.H. Munro

What is relative valuation?

- In relative valuation, the value of an asset is compared to the values assessed by the market for similar or comparable assets.
- To do relative valuation then,
  - we need to identify comparable assets and obtain market values for these assets
  - convert these market values into standardized values, since the absolute prices cannot be compared This process of standardizing creates price multiples.
  - compare the standardized value or multiple for the asset being analyzed to the standardized values for comparable asset, controlling for any differences between the firms that might affect the multiple, to judge whether the asset is under or over valued

Standardizing Value

- Prices can be standardized using a common variable such as earnings, cashflows, book value or revenues.
  - Earnings Multiples
    - Price/Earnings Ratio (PE) and variants (PEG and Relative PE)
    - Value/EBIT
    - Value/EBITDA
    - Value/Cash Flow
  - Book Value Multiples
    - Price/Book Value(of Equity) (PBV)
    - Value/ Book Value of Assets
    - Value/Replacement Cost (Tobin's Q)
  - Revenues
    - Price/Sales per Share (PS)
    - Value/Sales
  - Industry Specific Variable (Price/kwh, Price per ton of steel ....)

The Four Steps to Understanding Multiples

- Define the multiple
  - In use, the same multiple can be defined in different ways by different users. When comparing and using multiples, estimated by someone else, it is critical that we understand how the multiples have been estimated
- Describe the multiple
  - Too many people who use a multiple have no idea what its cross sectional distribution is. If you do not know what the cross sectional distribution of a multiple is, it is difficult to look at a number and pass judgment on whether it is too high or low.
- Analyze the multiple
  - It is critical that we understand the fundamentals that drive each multiple, and the nature of the relationship between the multiple and each variable.
- Apply the multiple
  - Defining the comparable universe and controlling for differences is far more difficult in practice than it is in theory.

Definitional Tests

- Is the multiple consistently defined?
  - **Proposition 1: Both the value (the numerator) and the standardizing variable (the denominator) should be to the same claimholders in the firm. In other words, the value of equity should be divided by equity earnings or equity book value, and firm value should be divided by firm earnings or book value.**
- Is the multiple uniformally estimated?
  - The variables used in defining the multiple should be estimated uniformly across assets in the "comparable firm" list.
  - If earnings-based multiples are used, the accounting rules to measure earnings should be applied consistently across assets. The same rule applies with book-value based multiples.

Descriptive Tests

- What is the average and standard deviation for this multiple, across the universe (market)?
- What is the median for this multiple?
  - The median for this multiple is often a more reliable comparison point.
- How large are the outliers to the distribution, and how do we deal with the outliers?
  - Throwing out the outliers may seem like an obvious solution, but if the outliers all lie on one side of the distribution (they usually are large positive numbers), this can lead to a biased estimate.
- Are there cases where the multiple cannot be estimated? Will ignoring these cases lead to a biased estimate of the multiple?
- How has this multiple changed over time?

Analytical Tests

- What are the fundamentals that determine and drive these multiples?
  - Proposition 2: Embedded in every multiple are all of the variables that drive every discounted cash flow valuation - growth, risk and cash flow patterns.
  - In fact, using a simple discounted cash flow model and basic algebra should yield the fundamentals that drive a multiple
- How do changes in these fundamentals change the multiple?
  - The relationship between a fundamental (like growth) and a multiple (such as PE) is seldom linear. For example, if firm A has twice the growth rate of firm B, it will generally not trade at twice its PE ratio
  - **Proposition 3: It is impossible to properly compare firms on a multiple, if we do not know the nature of the relationship between fundamentals and the multiple.**

Application Tests

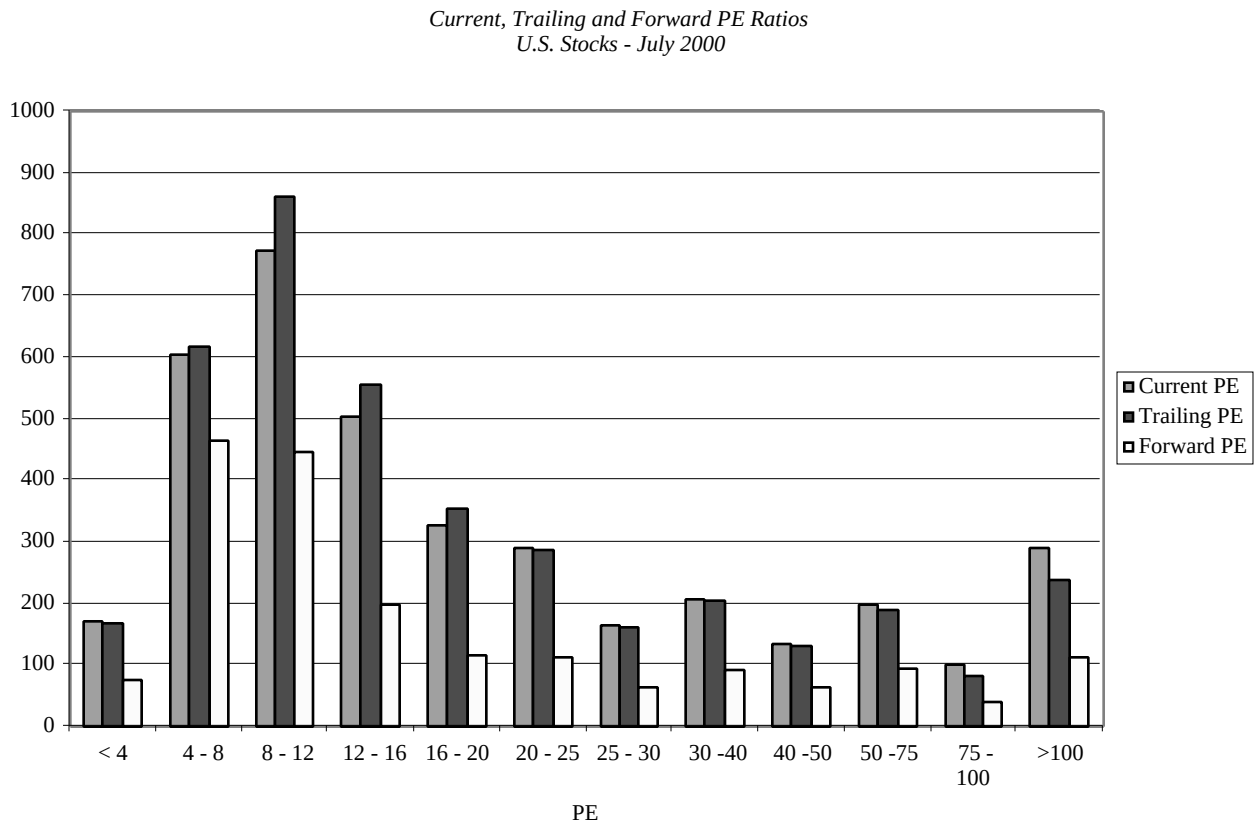
- Given the firm that we are valuing, what is a “comparable” firm?
  - While traditional analysis is built on the premise that firms in the same sector are comparable firms, valuation theory would suggest that a comparable firm is one which is similar to the one being analyzed in terms of fundamentals.
  - **Proposition 4: There is no reason why a firm cannot be compared with another firm in a very different business, if the two firms have the same risk, growth and cash flow characteristics.**
- Given the comparable firms, how do we adjust for differences across firms on the fundamentals?
  - **Proposition 5: It is impossible to find an exactly identical firm to the one you are valuing.**

Price Earnings Ratio: Definition

PE = Market Price per Share / Earnings per Share

- There are a number of variants on the basic PE ratio in use. They are based upon how the price and the earnings are defined.
- Price: is usually the current price
  is sometimes the average price for the year
- EPS: earnings per share in most recent financial year
  earnings per share in trailing 12 months (Trailing PE)
  forecasted earnings per share next year (Forward PE)
  forecasted earnings per share in future year

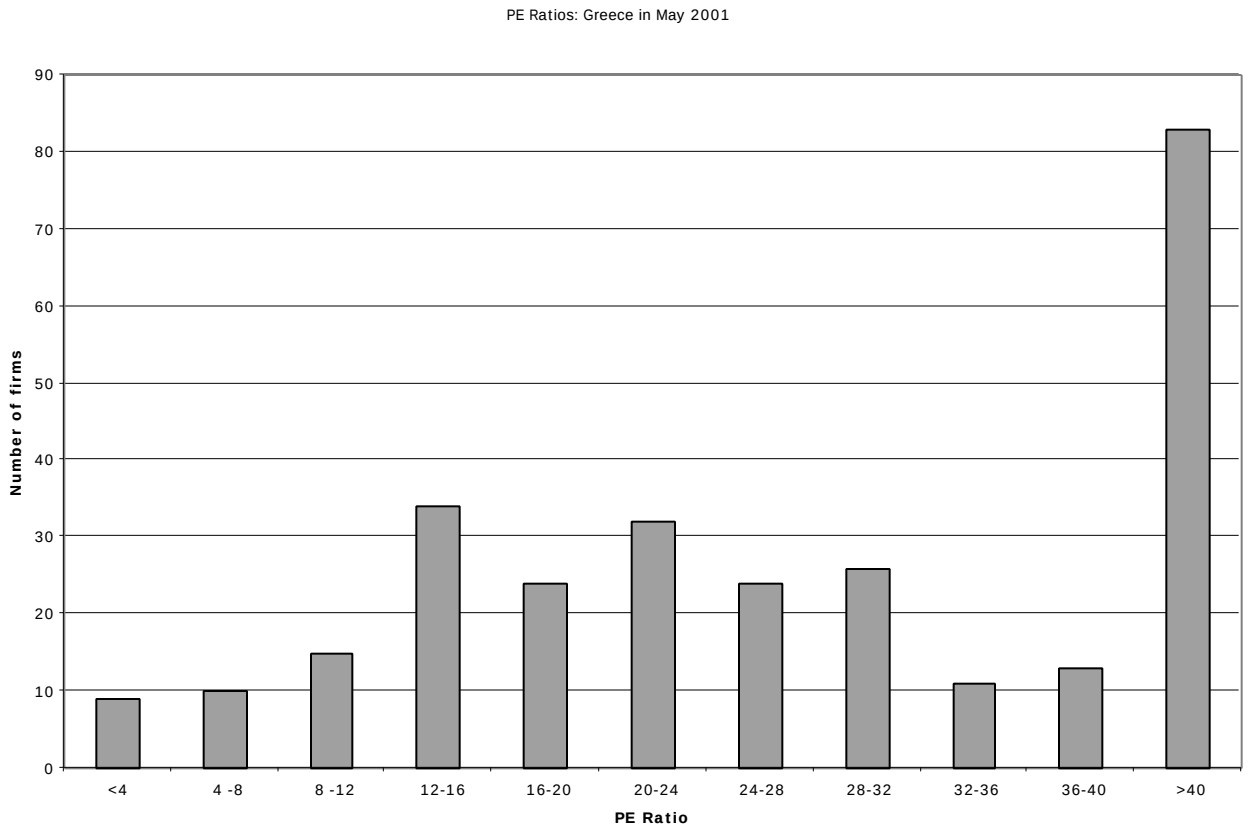
PE Ratio: Descriptive Statistics for the United States



PE: Deciphering the Distribution

	Current PE	Trailing PE	Forward PE
Mean	57.52	51.51	48.64
Standard Error	5.38	6.08	6.78
Median	14.47	13.68	11.52
Mode	12.00	7.00	7.50
Standard Deviation	330.59	377.93	294.10
Kurtosis	335.54	808.90	460.43
Skewness	17.12	25.96	19.59
Maximum	8043.03	14619.60	8184.40

PE Ratio: Greece in May 2001



PE Ratio: Understanding the Fundamentals

- To understand the fundamentals, start with a basic equity discounted cash flow model.
- With the dividend discount model,

$$P_0 = \frac{DPS_1}{r - g_n}$$

- Dividing both sides by the earnings per share,

$$\frac{P_0}{EPS_0} = PE = \frac{\text{Payout Ratio} * (1 + g_n)}{r - g_n}$$

- If this had been a FCFE Model,

$$P_0 = \frac{FCFE_1}{r - g_n}$$

$$\frac{P_0}{EPS_0} = PE = \frac{(FCFE/Earnings) * (1 + g_n)}{r - g_n}$$

PE Ratio and Fundamentals

- **Proposition: Other things held equal, higher growth firms will have higher PE ratios than lower growth firms.**
- **Proposition: Other things held equal, higher risk firms will have lower PE ratios than lower risk firms**
- **Proposition: Other things held equal, firms with lower reinvestment needs will have higher PE ratios than firms with higher reinvestment rates.**
- Of course, other things are difficult to hold equal since high growth firms, tend to have risk and high reinvestment rats.

Using the Fundamental Model to Estimate PE For a High Growth Firm

- The price-earnings ratio for a high growth firm can also be related to fundamentals. In the special case of the two-stage dividend discount model, this relationship can be made explicit fairly simply:

$$P_0 = \frac{EPS_0 * Payout\ Ratio * (1+g) * \left(1 - \frac{(1+g)^n}{(1+r)^n}\right)}{r-g} + \frac{EPS_0 * Payout\ Ratio_n * (1+g)^n * (1+g_n)}{(r-g_n)(1+r)^n}$$

  - For a firm that does not pay what it can afford to in dividends, substitute FCFE/Earnings for the payout ratio.

- Dividing both sides by the earnings per share:

$$\frac{P_0}{EPS_0} = \frac{Payout\ Ratio * (1+g) * \left(1 - \frac{(1+g)^n}{(1+r)^n}\right)}{r-g} + \frac{Payout\ Ratio_n * (1+g)^n * (1+g_n)}{(r-g_n)(1+r)^n}$$

A Simple Example

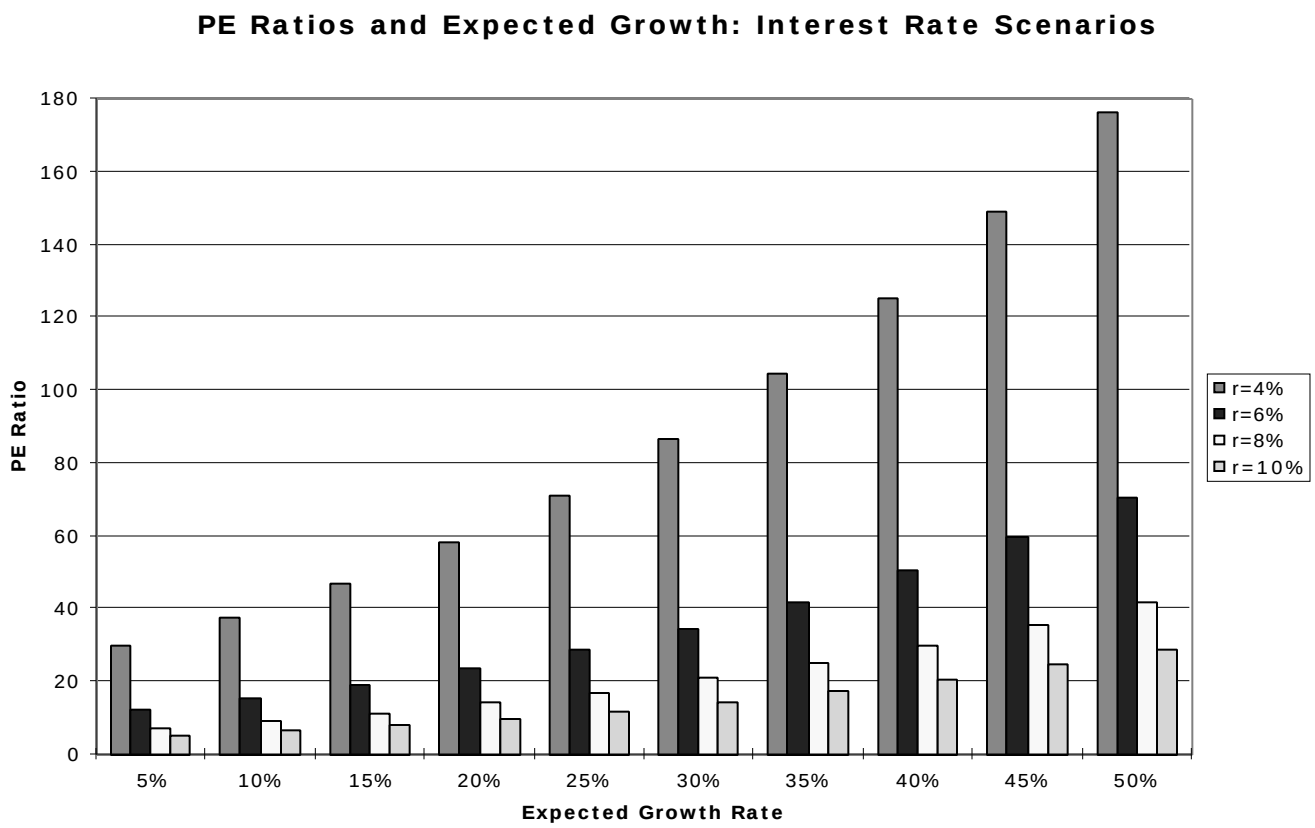
- Assume that you have been asked to estimate the PE ratio for a firm which has the following characteristics:

Variable	High Growth Phase	Stable Growth Phase
Expected Growth Rate	25%	8%
Payout Ratio	20%	50%
Beta	1.00	1.00

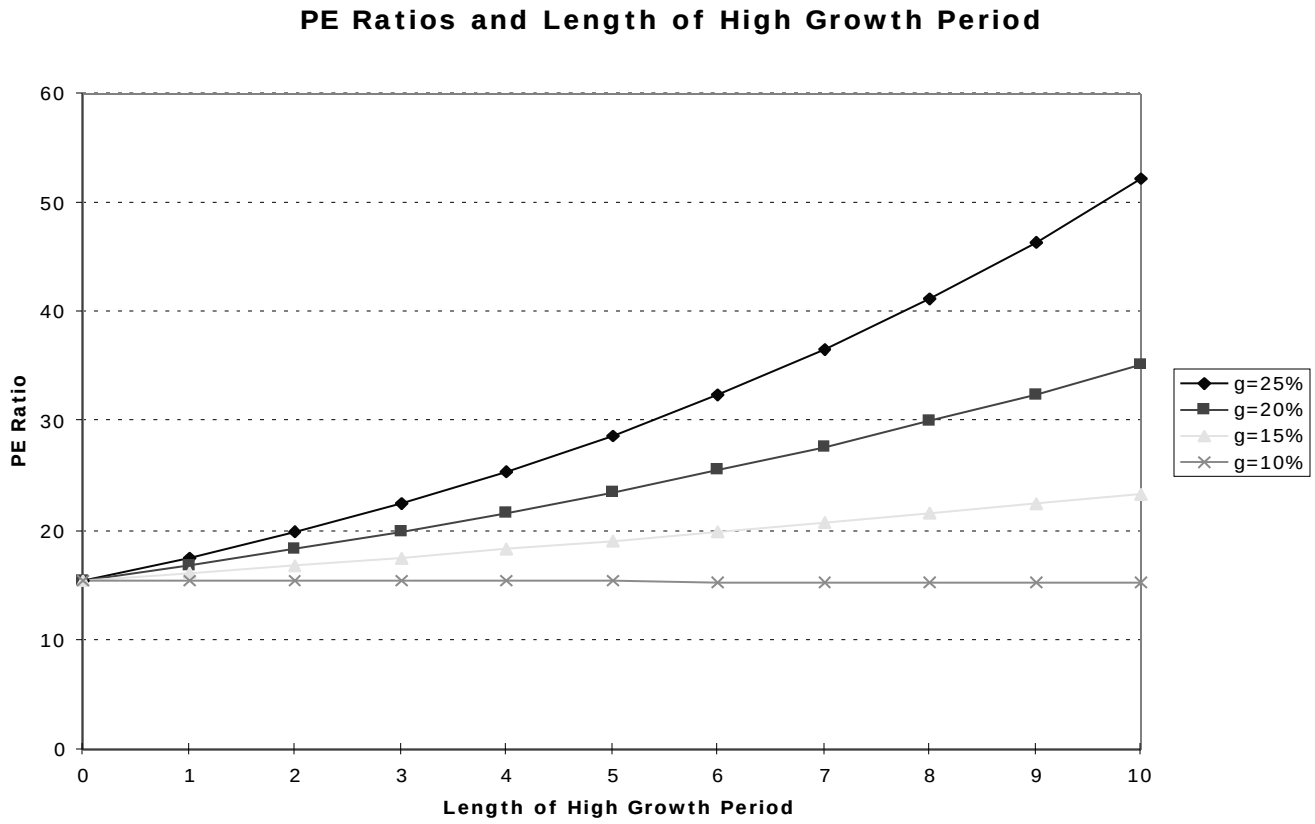
- Riskfree rate = T.Bond Rate = 6%
- Required rate of return = 6% + 1(5.5%)= 11.5%

$$PE = \frac{0.2 * (1.25) * \left(1 - \frac{(1.25)^5}{(1.115)^5}\right)}{(.115 - .25)} + \frac{0.5 * (1.25)^5 * (1.08)}{(.115-.08)(1.115)^5} = 28.75$$

PE and Growth: Firm grows at x% for 5 years, 8% thereafter

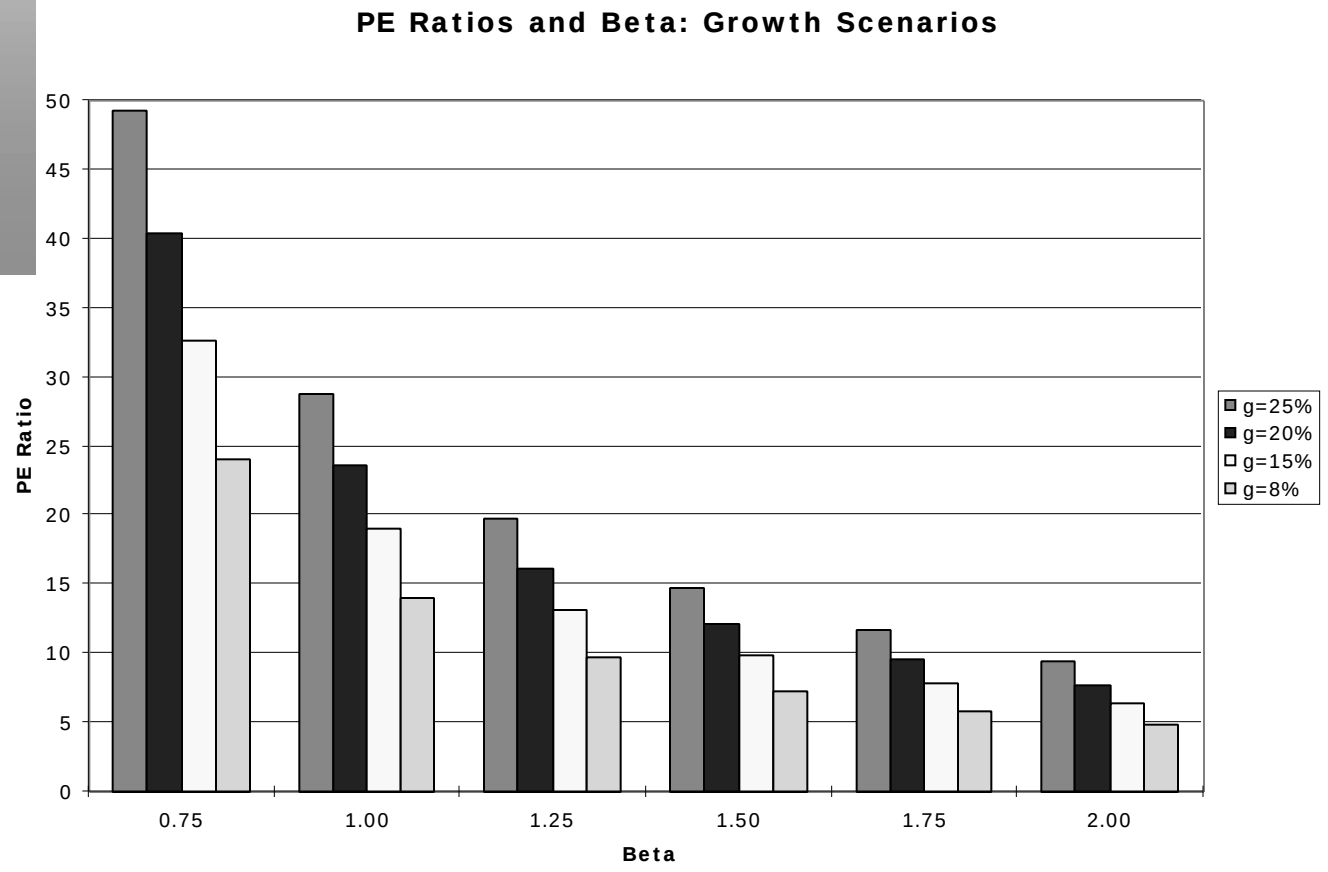


PE Ratios and Length of High Growth: 25% growth for n years; 8% thereafter

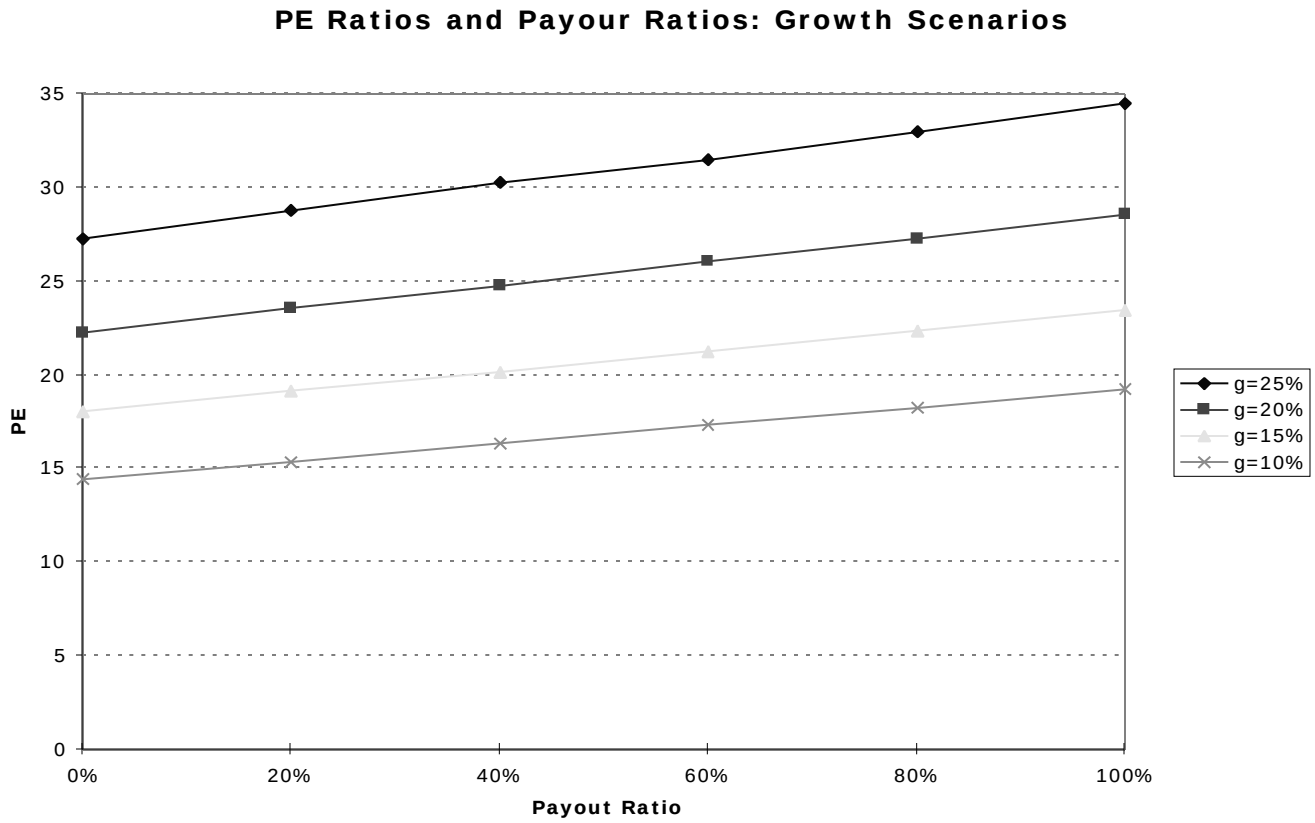


PE and Risk: Effects of Changing Betas on PE Ratio:

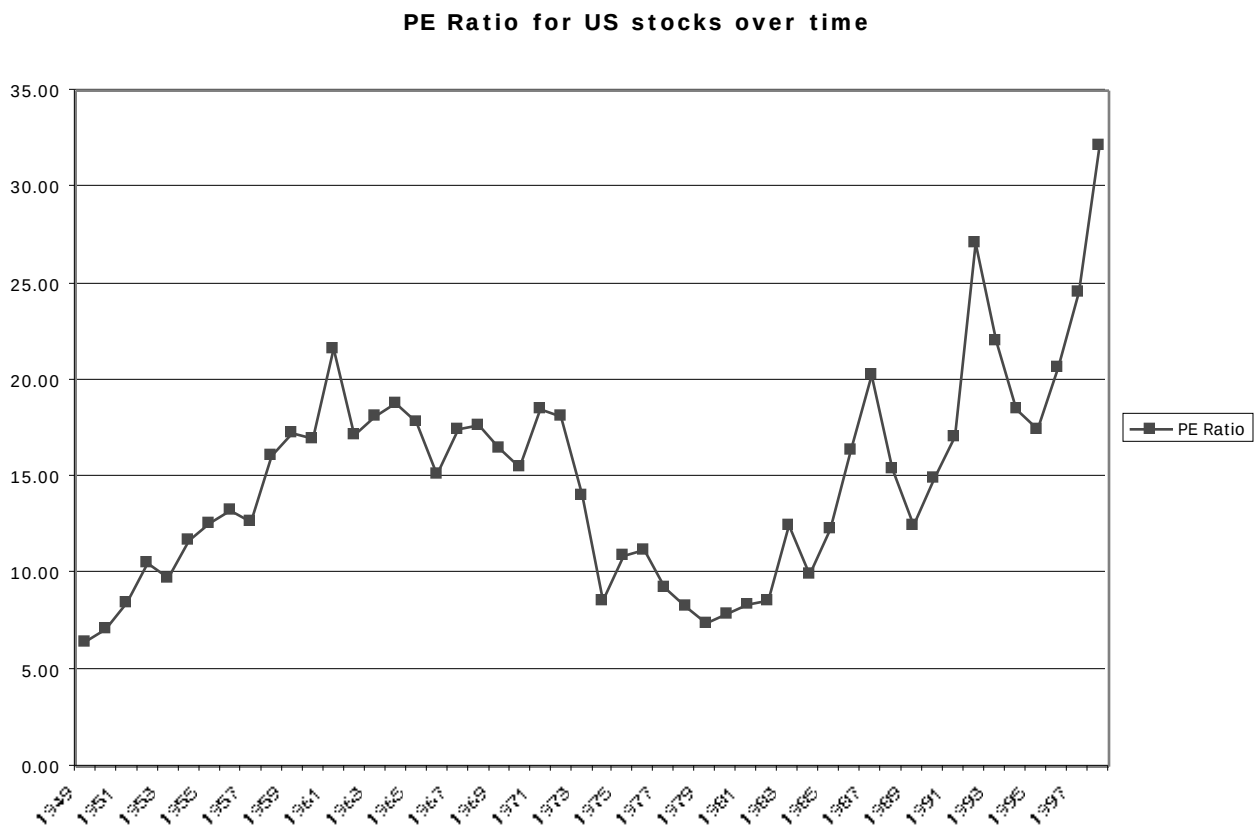
Firm with x% growth for 5 years; 8% thereafter



PE and Payout



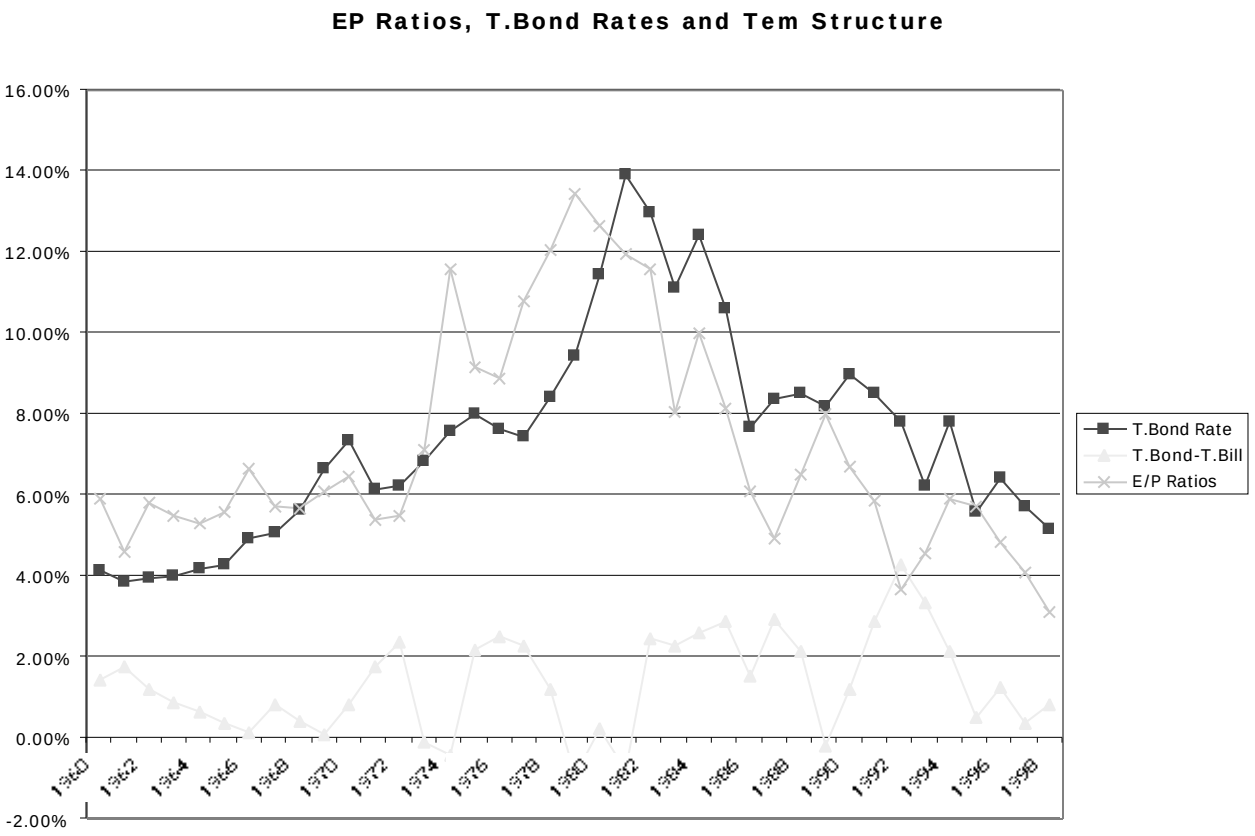
Comparisons of PE across time



Is low (high) PE cheap (expensive)?

- A market strategist argues that stocks are over priced because the PE ratio today is too high relative to the average PE ratio across time. Do you agree?
- Yes
- No
- If you do not agree, what factors might explain the higer PE ratio today?

E/P Ratios , T.Bond Rates and Term Structure



Regression Results

- There is a strong positive relationship between E/P ratios and T.Bond rates, as evidenced by the correlation of 0.6836 between the two variables.,
- In addition, there is evidence that the term structure also affects the PE ratio.
- In the following regression, using 1960-1999 data, we regress E/P ratios against the level of T.Bond rates and a term structure variable (T.Bond - T.Bill rate)

E/P = 2.82% + 0.749 T.Bond Rate - 0.847 (T.Bond Rate-T.Bill Rate)
(2.84) (6.78) (-3.65)

R squared = 60.67%

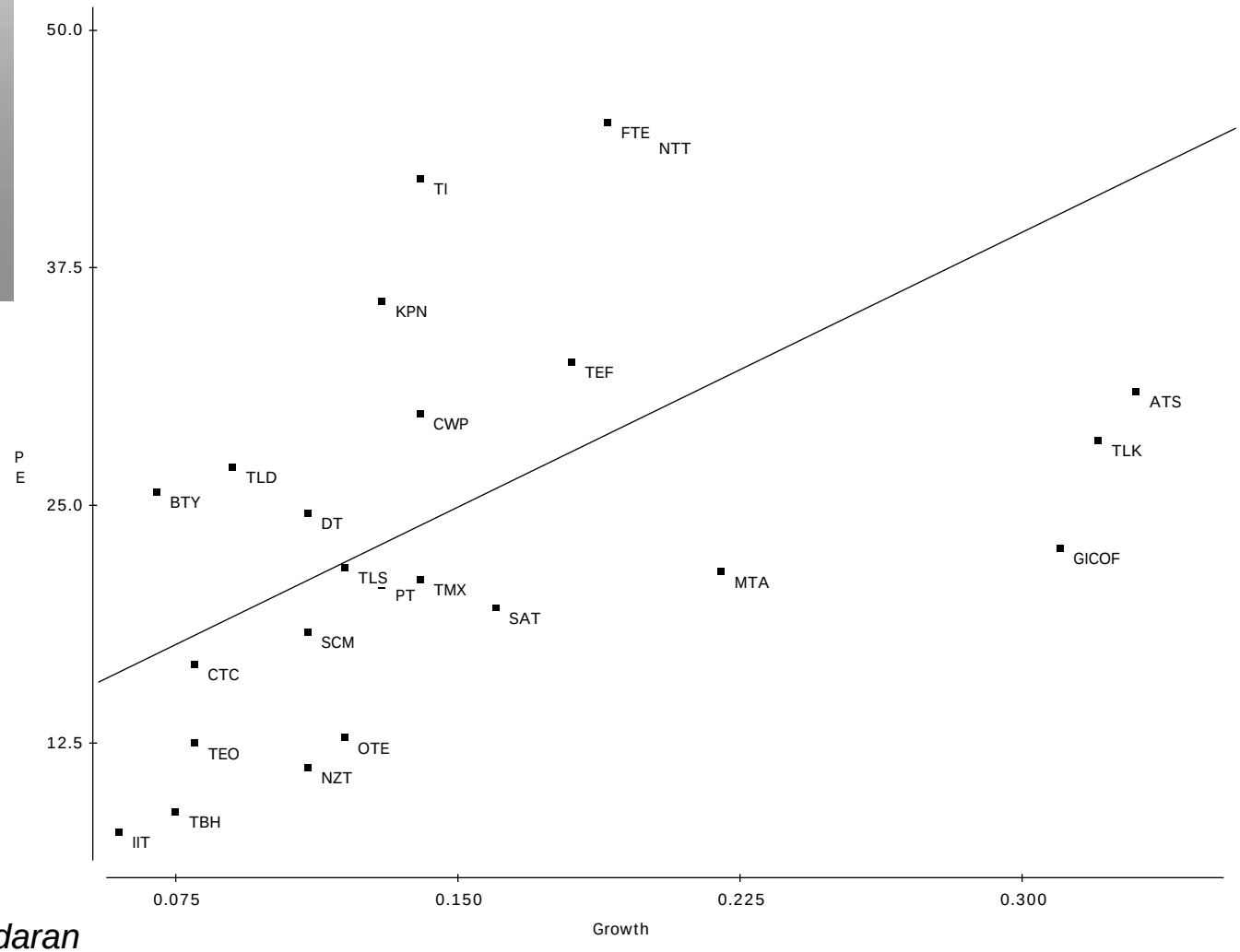
Estimate the E/P Ratio Today

- T. Bond Rate =
- T.Bond Rate - T.Bill Rate =
- Expected E/P Ratio =
- Expected PE Ratio =

Comparing PE ratios across firms

Company Name	PE	Growth
PT Indosat ADR	7.8	0.06
Telebras ADR	8.9	0.075
Telecom Corporation of New Zealand ADR	11.2	0.11
Telecom Argentina Stet - France Telecom SA ADR B	12.5	0.08
Hellenic Telecommunication Organization SA ADR	12.8	0.12
Telecomunicaciones de Chile ADR	16.6	0.08
Swisscom AG ADR	18.3	0.11
Asia Satellite Telecom Holdings ADR	19.6	0.16
Portugal Telecom SA ADR	20.8	0.13
Telefonos de Mexico ADR L	21.1	0.14
Matav RT ADR	21.5	0.22
Telstra ADR	21.7	0.12
Gilat Communications	22.7	0.31
Deutsche Telekom AG ADR	24.6	0.11
British Telecommunications PLC ADR	25.7	0.07
Tele Danmark AS ADR	27	0.09
Telekomunikasi Indonesia ADR	28.4	0.32
Cable & Wireless PLC ADR	29.8	0.14
APT Satellite Holdings ADR	31	0.33
Telefonica SA ADR	32.5	0.18
Royal KPN NV ADR	35.7	0.13
Telecom Italia SPA ADR	42.2	0.14
Nippon Telegraph & Telephone ADR	44.3	0.2
France Telecom SA ADR	45.2	0.19
Korea Telecom ADR	71.3	0.44

PE and Growth



PE, Growth and Risk

Dependent variable is: PE
No Selector

R squared = 66.2% R squared (adjusted) = 63.1%

Variable	Coefficient	SE	t-ratio	prob
Constant	13.1151	3.471	3.78	0.0010
Growth rate	121.223	19.27	6.29	≤ 0.0001
Emerging Market	-13.8531	3.606	-3.84	0.0009

Emerging Market is a dummy: 1 if emerging market
0 if not

Is Hellenic Telecom under valued?

- Predicted PE = 13.12 + 121.22 (.12) - 13.85 (0) = 27.67
- At an actual price to book value ratio of 12.2, Hellenic looks significantly under valued. However, if the market is pricing it as an emerging market telecomm:
- Predicted PE = 13.12 + 121.22 (.12) - 13.85 (1) = 13.82

A Question

You are reading an equity research report on this sector, and the analyst claims that Andres Wine and Hansen Natural are under valued because they have low PE ratios. Would you agree?

- Yes
- No
- Why or why not?

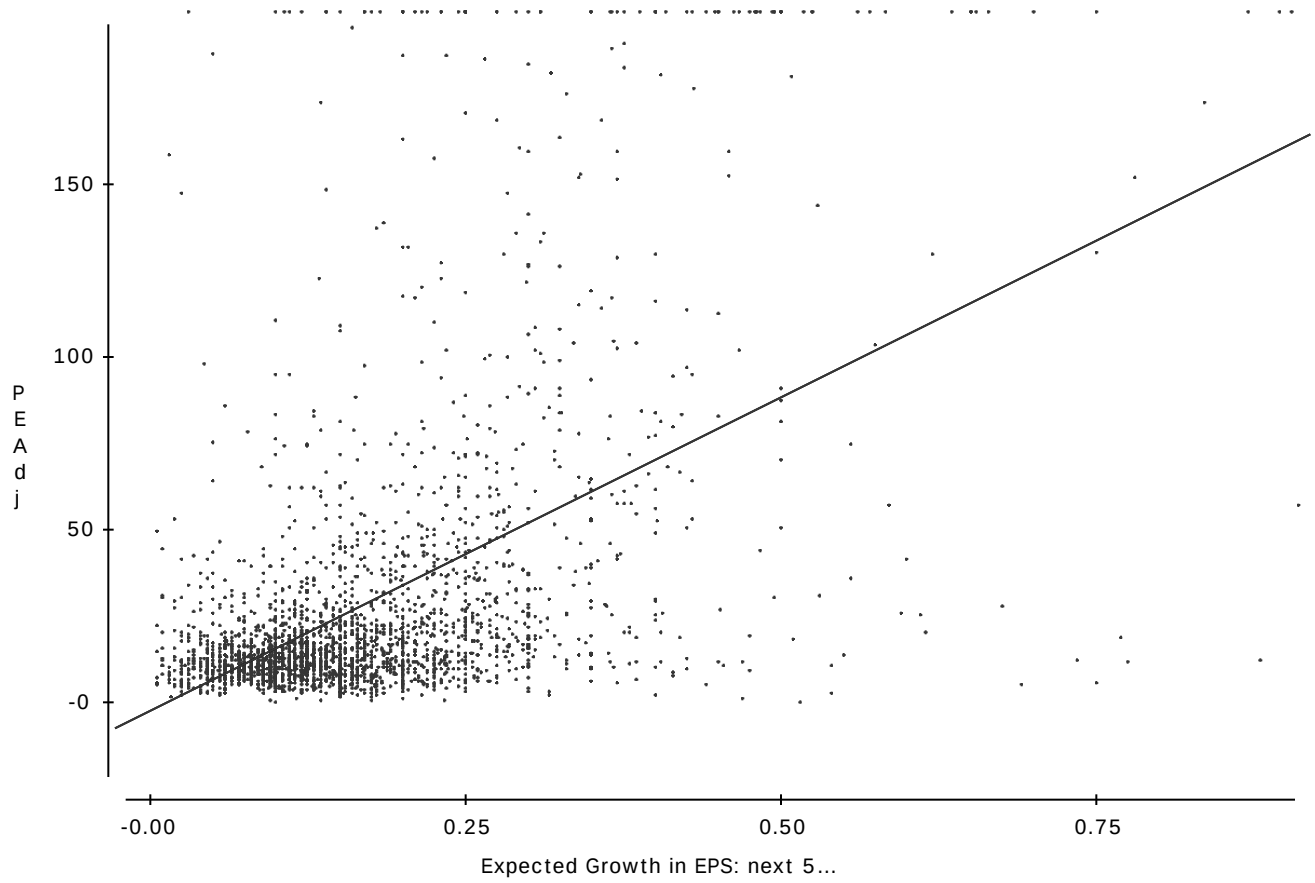
Using comparable firms- Pros and Cons

- The most common approach to estimating the PE ratio for a firm is
  - to choose a group of comparable firms,
  - to calculate the average PE ratio for this group and
  - to subjectively adjust this average for differences between the firm being valued and the comparable firms.
- Problems with this approach.
  - The definition of a 'comparable' firm is essentially a subjective one.
  - The use of other firms in the industry as the control group is often not a solution because firms within the same industry can have very different business mixes and risk and growth profiles.
  - There is also plenty of potential for bias.
  - Even when a legitimate group of comparable firms can be constructed, differences will continue to persist in fundamentals between the firm being valued and this group.

Using the entire crosssection: A regression approach

- In contrast to the 'comparable firm' approach, the information in the entire cross-section of firms can be used to predict PE ratios.
- The simplest way of summarizing this information is with a multiple regression, with the PE ratio as the dependent variable, and proxies for risk, growth and payout forming the independent variables.

PE versus Growth



PE Ratio: Standard Regression

Dependent variable is: **PEAdj**
No Selector
5903 total cases of which 3405 are missing
R squared = 24.9% R squared (adjusted) = 24.8%
s = 31.09 with 2498 - 4 = 2494 degrees of freedom

Source	Sum of Squares	df	Mean Square	F-ratio
Regression	798022	3	266007	275
Residual	2410686	2494	966.594	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	-17.2213	2.439	-7.06	≤ 0.0001
Expected Grow...	155.652	6.418	24.3	≤ 0.0001
Beta	16.4415	2.429	6.77	≤ 0.0001
Payout Ratio	10.9341	2.177	5.02	≤ 0.0001

Second Thoughts?

- Based on this regression, estimate the PE ratio for a firm with no growth, no payout and no risk.

- Is there a problem with your prediction?

PE Regression- No Intercept

Dependent variable is: **PEAdj**
No Selector
5903 total cases of which 3405 are missing
R squared = •% R squared (adjusted) = •%
s = 31.39 with 2498 - 3 = 2495 degrees of freedom

Source	Sum of Squares	df	Mean Square	F-ratio
Regression	2408918	3	802973	815
Residual	2458878	2495	985.522	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Payout Ratio	3.19821	1.900	1.68	0.0924
Beta	2.37185	1.403	1.69	0.0909
Expected Grow...	145.317	6.310	23.0	≤ 0.0001

Problems with the regression methodology

- The basis regression assumes a linear relationship between PE ratios and the financial proxies, and that might not be appropriate.
- The basic relationship between PE ratios and financial variables itself might not be stable, and if it shifts from year to year, the predictions from the model may not be reliable.
- The independent variables are correlated with each other. For example, high growth firms tend to have high risk. This multi-collinearity makes the coefficients of the regressions unreliable and may explain the large changes in these coefficients from period to period.

The Multicollinearity Problem

	PE	Exp Growt	Beta	Payout
PE	1.000			
Exp Growt…	0.288	1.000		
Beta	0.141	0.292**	1.000	
Payout	-0.087	-0.404**	-0.183*	1.000

- The independent variables are correlated with the dependent variable, which is a good thing, but they are also correlated with each other (which is not a good thing)
- This will cause the standard errors on the coefficients to become larger and some coefficients may have the wrong sign.

Using the PE ratio regression

- Assume that you were given the following information for Dell. The firm has an expected growth rate of 20%, a beta of 1.40 and pays no dividends. Based upon the regression, estimate the predicted PE ratio for Dell.

- Dell is actually trading at 23 times earnings. What does the predicted PE tell you?

Value/Earnings and Value/Cashflow Ratios

- While Price earnings ratios look at the market value of equity relative to earnings to equity investors, Value earnings ratios look at the market value of the firm relative to operating earnings. Value to cash flow ratios modify the earnings number to make it a cash flow number.
- The form of value to cash flow ratios that has the closest parallels in DCF valuation is the value to Free Cash Flow to the Firm, which is defined as:

$$\text{Value/FCFF} = \frac{\text{(Market Value of Equity + Market Value of Debt)}}{\text{EBIT (1-t) - (Cap Ex - Deprecn) - Chg in WC}}$$

- Consistency Tests:
  - If the numerator is net of cash (or if net debt is used, then the interest income from the cash should not be in denominator
  - The interest expenses added back to get to EBIT should correspond to the debt in the numerator. If only long term debt is considered, only long term interest should be added back.

Value of Firm/FCFF: Determinants

- Reverting back to a two-stage FCFF DCF model, we get:

$$V_0 = \frac{FCFF_0 (1+g) \left(1 - \frac{(1+g)^n}{(1+WACC)^n}\right)}{WACC - g} + \frac{FCFF_0 (1+g)^n (1+g_n)}{(WACC - g_n)(1+WACC)^n}$$

- V_0 = Value of the firm (today)
- $FCFF_0$ = Free Cashflow to the firm in current year
- g = Expected growth rate in FCFF in extraordinary growth period (first n years)
- WACC = Weighted average cost of capital
- g_n = Expected growth rate in FCFF in stable growth period (after n years)

Value Multiples

- Dividing both sides by the FCFF yields,

$$\frac{V_0}{FCFF_0} = \frac{(1+g)\left(1-\frac{(1+g)^n}{(1+WACC)^n}\right)}{WACC-g} + \frac{(1+g)^n(1+g_n)}{(WACC-g_n)(1+WACC)^n}$$

- The value/FCFF multiples is a function of
  - the cost of capital
  - the expected growth

Alternatives to FCFF - EBIT and EBITDA

- Most analysts find FCFF to complex or messy to use in multiples (partly because capital expenditures and working capital have to be estimated). They use modified versions of the multiple with the following alternative denominator:
  - after-tax operating income or EBIT(1-t)
  - pre-tax operating income or EBIT
  - net operating income (NOI), a slightly modified version of operating income, where any non-operating expenses and income is removed from the EBIT
  - EBITDA, which is earnings before interest, taxes, depreciation and amortization.

Value/FCFF Multiples and the Alternatives

- Assume that you have computed the value of a firm, using discounted cash flow models. Rank the following multiples in the order of magnitude from lowest to highest?
  - Value/EBIT
  - Value/EBIT(1-t)
  - Value/FCFF
  - Value/EBITDA
- What assumption(s) would you need to make for the Value/EBIT(1-t) ratio to be equal to the Value/FCFF multiple?

Illustration: Using Value/FCFF Approaches to value a firm: MCI Communications

- MCI Communications had earnings before interest and taxes of $3356 million in 1994 (Its net income after taxes was $855 million).
- It had capital expenditures of $2500 million in 1994 and depreciation of $1100 million; Working capital increased by $250 million.
- It expects free cashflows to the firm to grow 15% a year for the next five years and 5% a year after that.
- The cost of capital is 10.50% for the next five years and 10% after that.
- The company faces a tax rate of 36%.

$$\frac{V_0}{FCFF_0} = \frac{(1.15)\left(1-\frac{(1.15)^5}{(1.105)^5}\right)}{.105-.15} + \frac{(1.15)^5(1.05)}{(.10-.05)(1.105)^5} = 31.28$$

Multiple Magic

- In this case of MCI there is a big difference between the FCFF and short cut measures. For instance the following table illustrates the appropriate multiple using short cut measures, and the amount you would overpay by if you used the FCFF multiple.

Free Cash Flow to the Firm

= EBIT (1-t) - Net Cap Ex - Change in Working Capital

= 3356 (1 - 0.36) + 1100 - 2500 - 250 = $ 498 million

	$ Value	*Correct Multiple*
FCFF	$498	31.28382355
EBIT (1-t)	$2,148	7.251163362
EBIT	$ 3,356	4.640744552
EBITDA	$4,456	3.49513885

Value/EBITDA Multiple

- The Classic Definition

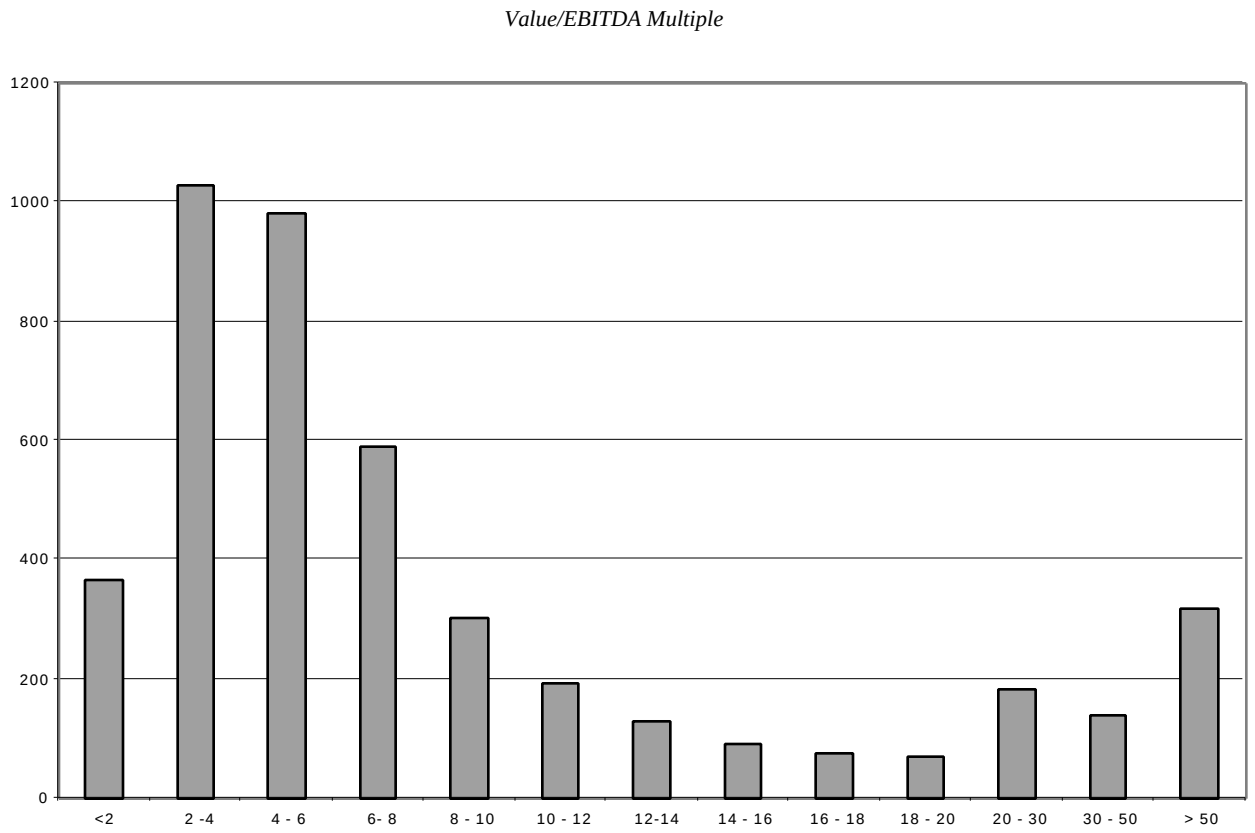
$$\frac{\text{Value}}{\text{EBITDA}} = \frac{\text{Market Value of Equity + Market Value of Debt}}{\text{Earnings before Interest, Taxes and Depreciation}}$$

- The No-Cash Version

$$\frac{\text{Value}}{\text{EBITDA}} = \frac{\text{Market Value of Equity + Market Value of Debt - Cash}}{\text{Earnings before Interest, Taxes and Depreciation}}$$

- When cash and marketable securities are netted out of value, none of the income from the cash and securities should be reflected in the denominator.

Value/EBITDA Distribution



The Determinants of Value/EBITDA Multiples: Linkage to DCF Valuation

- Firm value can be written as:

$$V_0 = \frac{FCFF_1}{WACC - g}$$

- The numerator can be written as follows:

FCFF = EBIT (1-t) - (Cex - Depr) - Δ Working Capital

= (EBITDA - Depr) (1-t) - (Cex - Depr) - Δ Working Capital

= EBITDA (1-t) + Depr (t) - Cex - Δ Working Capital

From Firm Value to EBITDA Multiples

- Now the Value of the firm can be rewritten as,

$$\text{Value} = \frac{\text{EBITDA}\ (1-t) + \text{Depr}\ (t) - \text{Cex} - \Delta\ \text{Working Capital}}{\text{WACC} - g}$$

- Dividing both sides of the equation by EBITDA,

$$\frac{\text{Value}}{\text{EBITDA}} = \frac{(1-t)}{\text{WACC} - g} + \frac{\text{Depr}\ (t)/\text{EBITDA}}{\text{WACC} - g} - \frac{\text{CEx/EBITDA}}{\text{WACC} - g} - \frac{\Delta\ \text{Working Capital/EBITDA}}{\text{WACC} - g}$$

A Simple Example

- Consider a firm with the following characteristics:
  - Tax Rate = 36%
  - Capital Expenditures/EBITDA = 30%
  - Depreciation/EBITDA = 20%
  - Cost of Capital = 10%
  - The firm has no working capital requirements
  - The firm is in stable growth and is expected to grow 5% a year forever.
  - Note that the return on capital implied in this growth rate can be calculated as follows:

    g = ROC * Reinvestment Rate

    .05 = ROC * Net Cap Ex/EBIT (1-t)

    = ROC * (.30-.20)/[(1-.2)(1-.36)]

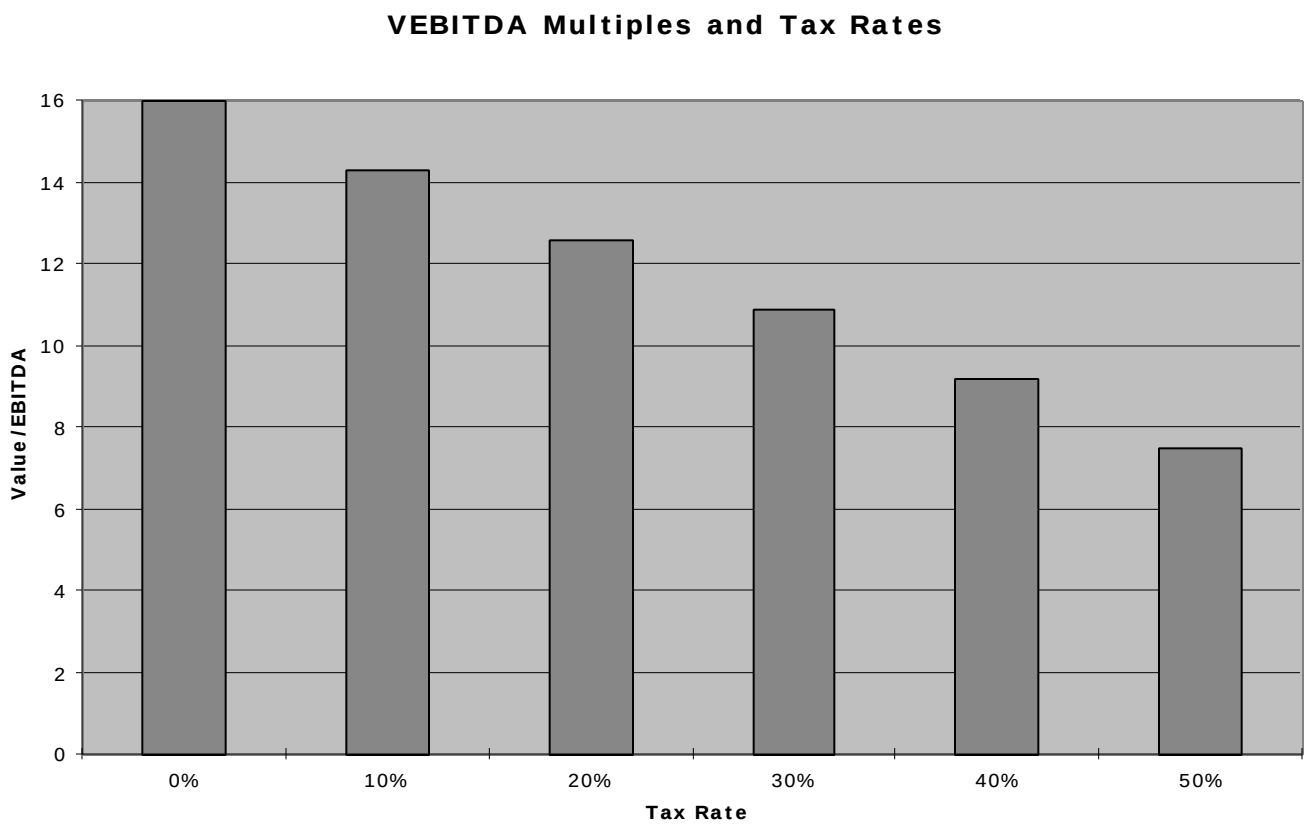
  Solving for ROC, ROC = 25.60%

Calculating Value/EBITDA Multiple

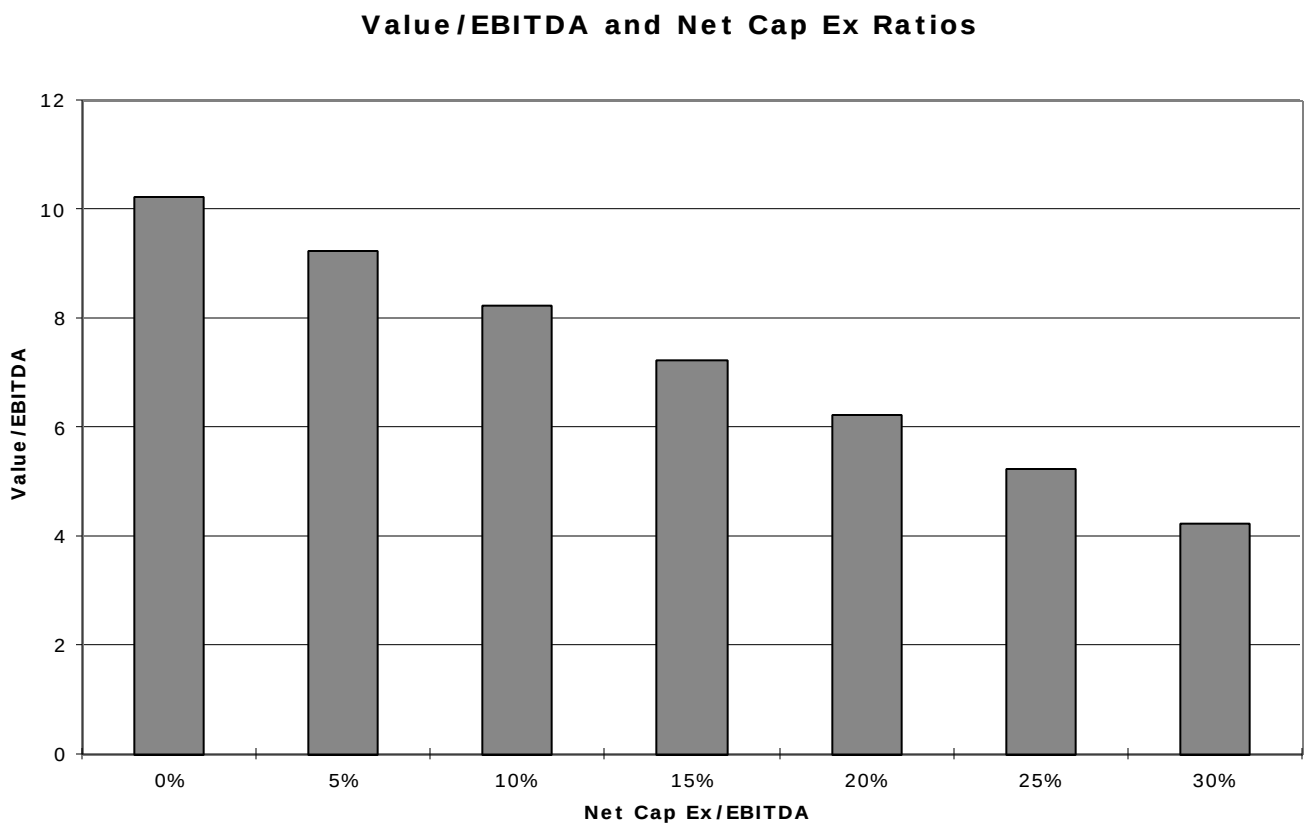
- In this case, the Value/EBITDA multiple for this firm can be estimated as follows:

$$\frac{\text{Value}}{\text{EBITDA}} = \frac{(1-.36)}{.10-.05} + \frac{(0.2)(.36)}{.10-.05} - \frac{0.3}{.10-.05} - \frac{0}{.10-.05} = 8.24$$

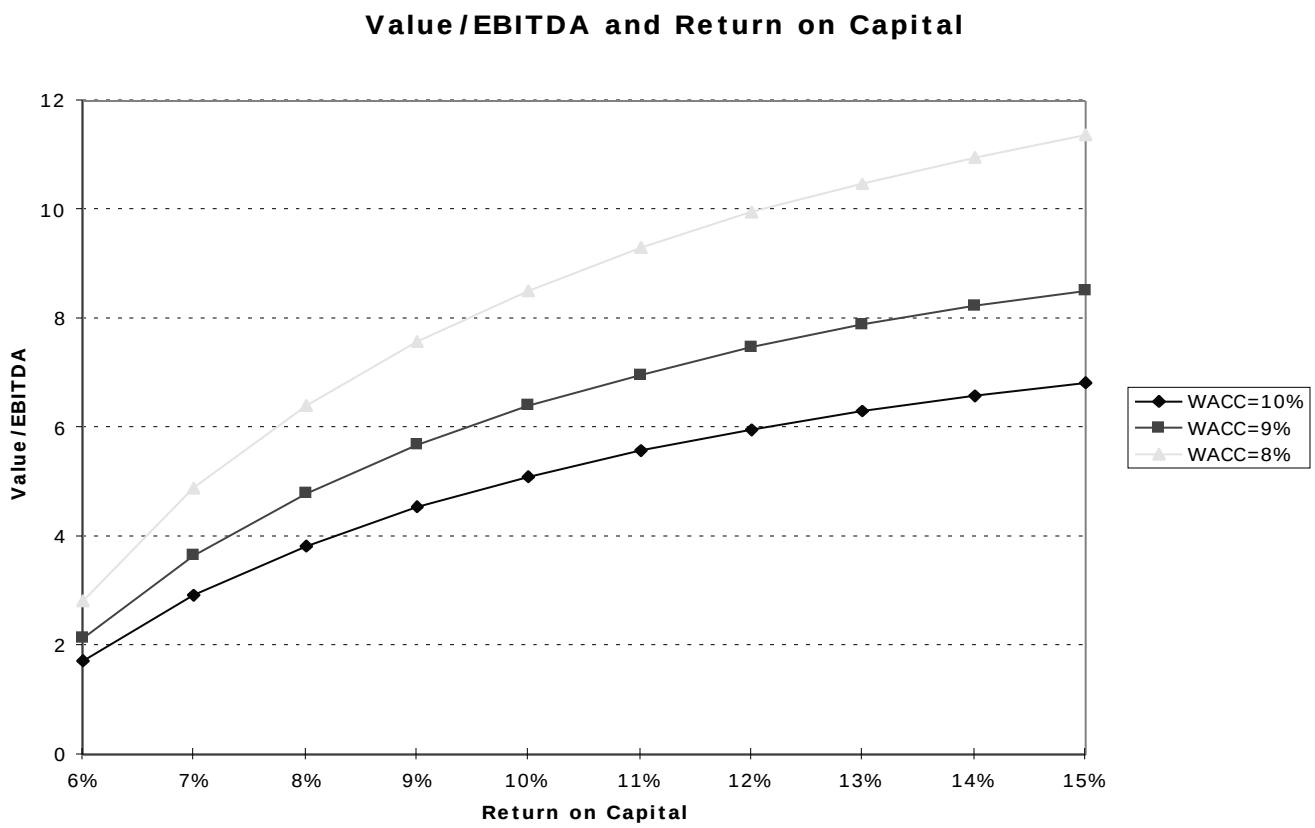
Value/EBITDA Multiples and Taxes



Value/EBITDA and Net Cap Ex



Value/EBITDA Multiples and Return on Capital



Value/EBITDA Multiple: Trucking Companies

Company Name	*Value*	*EBITDA*	*Value/EBITDA*
KLLM Trans. Svcs.	$ 114.32	$ 48.81	2.34
Ryder System	$ 5,158.04	$ 1,838.26	2.81
Rollins Truck Leasing	$ 1,368.35	$ 447.67	3.06
Cannon Express Inc.	$ 83.57	$ 27.05	3.09
Hunt (J.B.)	$ 982.67	$ 310.22	3.17
Yellow Corp.	$ 931.47	$ 292.82	3.18
Roadway Express	$ 554.96	$ 169.38	3.28
Marten Transport Ltd.	$ 116.93	$ 35.62	3.28
Kenan Transport Co.	$ 67.66	$ 19.44	3.48
M.S. Carriers	$ 344.93	$ 97.85	3.53
Old Dominion Freight	$ 170.42	$ 45.13	3.78
Trimac Ltd	$ 661.18	$ 174.28	3.79
Matlack Systems	$ 112.42	$ 28.94	3.88
XTRA Corp.	$ 1,708.57	$ 427.30	4.00
Covenant Transport Inc	$ 259.16	$ 64.35	4.03
Builders Transport	$ 221.09	$ 51.44	4.30
Werner Enterprises	$ 844.39	$ 196.15	4.30
Landstar Sys.	$ 422.79	$ 95.20	4.44
AMERCO	$ 1,632.30	$ 345.78	4.72
USA Truck	$ 141.77	$ 29.93	4.74
Frozen Food Express	$ 164.17	$ 34.10	4.81
Arnold Inds.	$ 472.27	$ 96.88	4.87
Greyhound Lines Inc.	$ 437.71	$ 89.61	4.88
USFreightways	$ 983.86	$ 198.91	4.95
Golden Eagle Group Inc.	$ 12.50	$ 2.33	5.37
Arkansas Best	$ 578.78	$ 107.15	5.40
Airlease Ltd.	$ 73.64	$ 13.48	5.46
Celadon Group	$ 182.30	$ 32.72	5.57
Amer. Freightways	$ 716.15	$ 120.94	5.92
Transfinancial Holdings	$ 56.92	$ 8.79	6.47
Vitran Corp. 'A'	$ 140.68	$ 21.51	6.54
Interpool Inc.	$ 1,002.20	$ 151.18	6.63
Intrenet Inc.	$ 70.23	$ 10.38	6.77
Swift Transportation	$ 835.58	$ 121.34	6.89
Landair Services	$ 212.95	$ 30.38	7.01
CNF Transportation	$ 2,700.69	$ 366.99	7.36
Budget Group Inc	$ 1,247.30	$ 166.71	7.48
Caliber System	$ 2,514.99	$ 333.13	7.55
Knight Transportation Inc	$ 269.01	$ 28.20	9.54
Heartland Express	$ 727.50	$ 64.62	11.26
Greyhound CDA Transn Corp	$ 83.25	$ 6.99	11.91
Mark VII	$ 160.45	$ 12.96	12.38
Coach USA Inc	$ 678.38	$ 51.76	13.11
US 1 Inds Inc.	$ 5.60	$ (0.17)	NA
Average			**5.61**

A Test on EBITDA

- Ryder System looks very cheap on a Value/EBITDA multiple basis, relative to the rest of the sector. What explanation (other than misvaluation) might there be for this difference?

Value/EBITDA Multiples: Market

- The multiple of value to EBITDA varies widely across firms in the market, depending upon:
  - how capital intensive the firm is (high capital intensity firms will tend to have lower value/EBITDA ratios), and how much reinvestment is needed to keep the business going and create growth
  - how high or low the cost of capital is (higher costs of capital will lead to lower Value/EBITDA multiples)
  - how high or low expected growth is in the sector (high growth sectors will tend to have higher Value/EBITDA multiples)

US Market: Cross Sectional Regression

Dependent variable is: **AdjVeBITDA**
No Selector
5903 total cases of which 2943 are missing
R squared = 22.0% R squared (adjusted) = 22.0%
s = 11.26 with 2960 - 4 = 2956 degrees of freedom

Source	Sum of Squares	df	Mean Square	F-ratio
Regression	106063	3	35354.4	279
Residual	375086	2956	126.890	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	27.8050	0.6408	43.4	≤ 0.0001
CpExVal	-4.18185	2.345	-1.78	0.0747
lnGrowth	7.86554	0.3021	26.0	≤ 0.0001
Eff. Tax Rate	-7.65961	0.7666	-9.99	≤ 0.0001

Price-Book Value Ratio: Definition

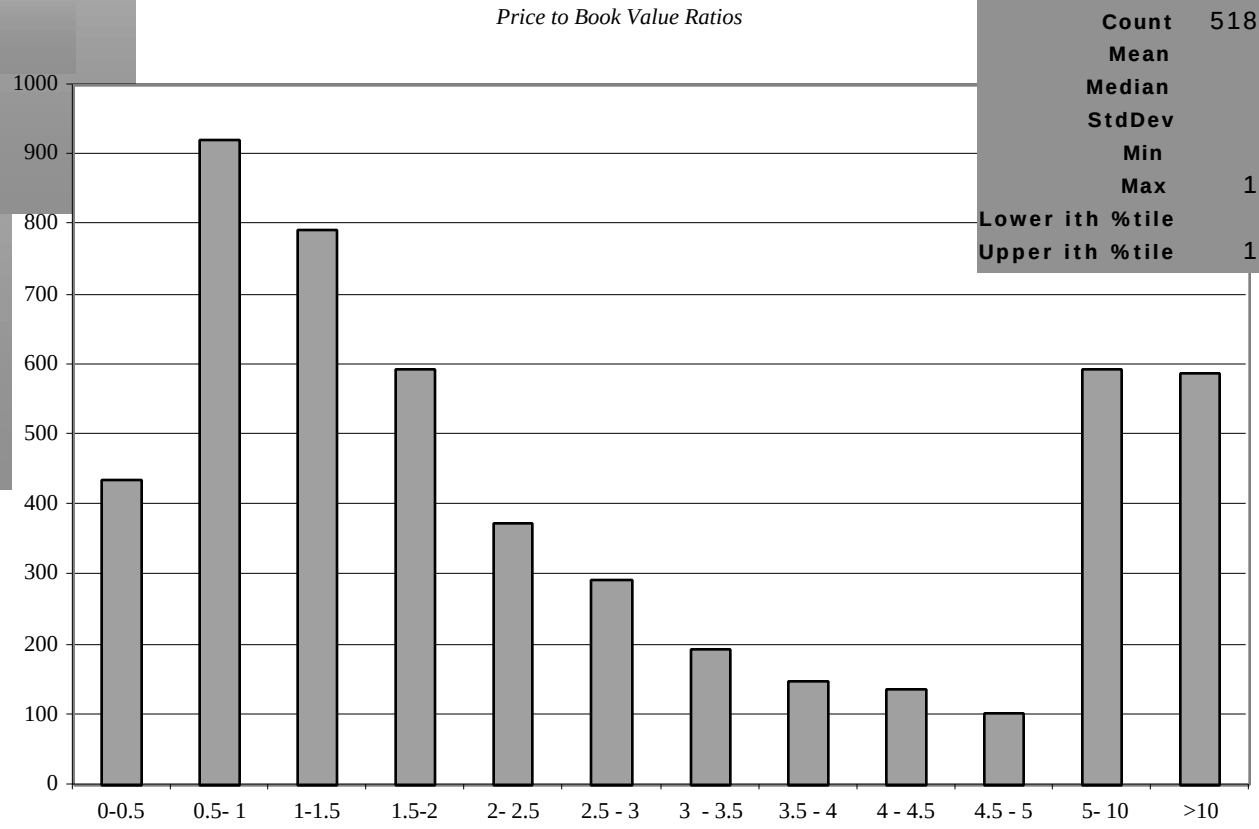
- The price/book value ratio is the ratio of the market value of equity to the book value of equity, i.e., the measure of shareholders' equity in the balance sheet.
- Price/Book Value = $\frac{\text{Market Value of Equity}}{\text{Book Value of Equity}}$
- Consistency Tests:
  - If the market value of equity refers to the market value of equity of common stock outstanding, the book value of common equity should be used in the denominator.
  - If there is more that one class of common stock outstanding, the market values of all classes (even the non-traded classes) needs to be factored in.

Price to Book Value: Distribution

Summary of Price/BV
No Selector
5941 total cases of which 755 are missing

Percentile 5

Count	5186
Mean	3.84904
Median	1.92370
StdDev	4.37355
Min	0.009296
Max	15
Lower ith %tile	0.430182
Upper ith %tile	15



Price Book Value Ratio: Stable Growth Firm

- Going back to a simple dividend discount model,

$$P_0 = \frac{DPS_1}{r - g_n}$$

- Defining the return on equity (ROE) = EPS_0 / Book Value of Equity, the value of equity can be written as:

$$P_0 = \frac{BV_0 * ROE * Payout\ Ratio * (1 + g_n)}{r - g_n}$$

$$\frac{P_0}{BV_0} = PBV = \frac{ROE * Payout\ Ratio * (1 + g_n)}{r - g_n}$$

- If the return on equity is based upon expected earnings in the next time period, this can be simplified to,

$$\frac{P_0}{BV_0} = PBV = \frac{ROE * Payout\ Ratio}{r - g_n}$$

PBV/ROE: Oil Companies

Company Name	*Ticker Symbol*	*PBV*	*ROE*
Crown Cent. Petr.'A'	CNPA	0.29	-14.60%
Giant Industries	GI	0.54	7.47%
Harken Energy Corp.	HEC	0.64	-5.83%
Getty Petroleum Mktg.	GPM	0.95	6.26%
Pennzoil-Quaker State	PZL	0.95	3.99%
Ashland Inc.	ASH	1.13	10.27%
Shell Transport	SC	1.45	13.41%
USX-Marathon Group	MRO	1.59	13.42%
Lakehead Pipe Line	LHP	1.72	13.28%
Amerada Hess	AHC	1.77	16.69%
Tosco Corp.	TOS	1.95	15.44%
Occidental Petroleum	OXY	2.15	16.68%
Royal Dutch Petr.	RD	2.33	13.41%
Murphy Oil Corp.	MUR	2.40	14.49%
Texaco Inc.	TX	2.44	13.77%
Phillips Petroleum	P	2.64	17.92%
Chevron Corp.	CHV	3.03	15.69%
Repsol-YPF ADR	REP	3.24	13.43%
Unocal Corp.	UCL	3.53	10.67%
Kerr-McGee Corp.	KMG	3.59	28.88%
Exxon Mobil Corp.	XOM	4.22	11.20%
BP Amoco ADR	BPA	4.66	14.34%
Clayton Williams Energy	CWEI	5.57	31.02%
Average		2.30	12.23%

PBV versus ROE regression

- Regressing PBV ratios against ROE for oil companies yields the following regression:

$$PBV = 1.04 + 10.24\ (ROE) \qquad R^2 = 49\%$$

- For every 1% increase in ROE, the PBV ratio should increase by 0.1024.

Valuing Pemex

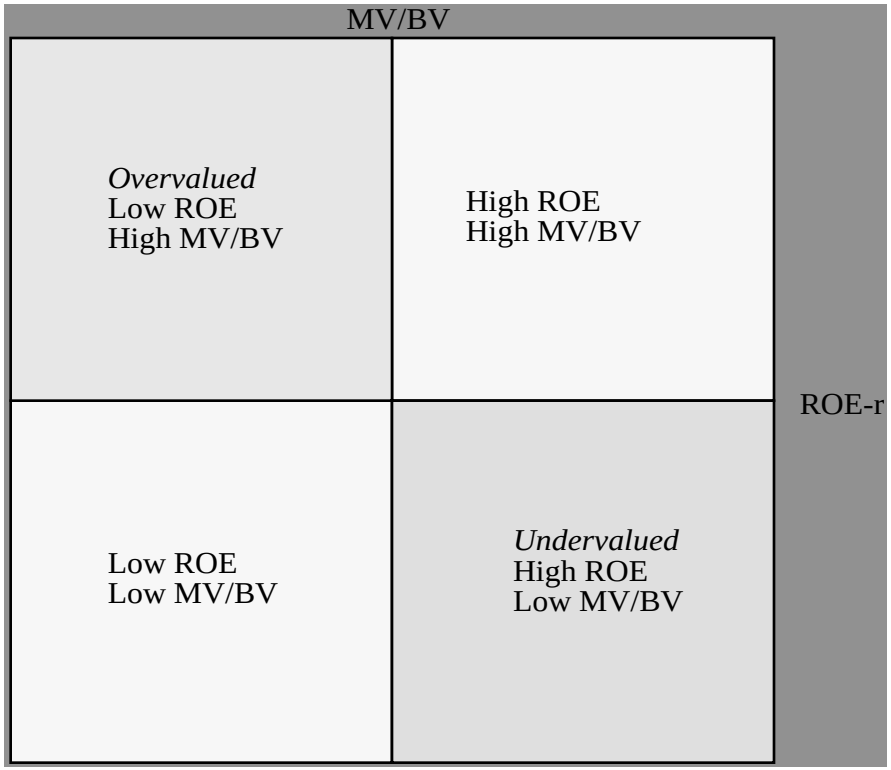
- Assume that you have been asked to value a PEMEX for the Mexican Government; All you know is that it has earned a return on equity of 10% last year. The appropriate P/BV ratio can be estimated

  P/BV Ratio (based upon regression) = 1.04 + 10.24 * 0.1 = 2.06

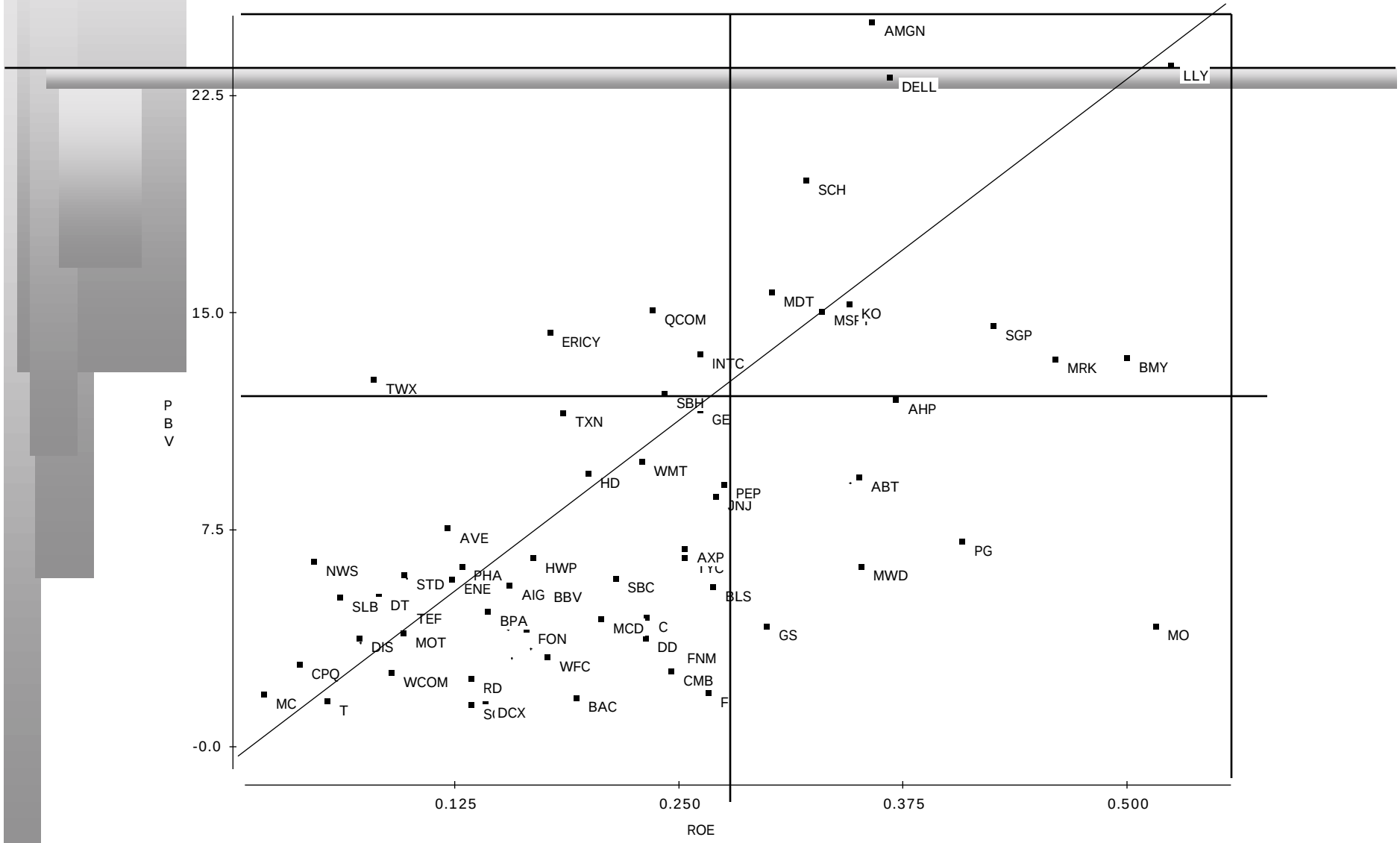
Looking for undervalued securities - PBV Ratios and ROE

- Given the relationship between price-book value ratios and returns on equity, it is not surprising to see firms which have high returns on equity selling for well above book value and firms which have low returns on equity selling at or below book value.
- The firms which should draw attention from investors are those which provide mismatches of price-book value ratios and returns on equity - low P/BV ratios and high ROE or high P/BV ratios and low ROE.

The Valuation Matrix



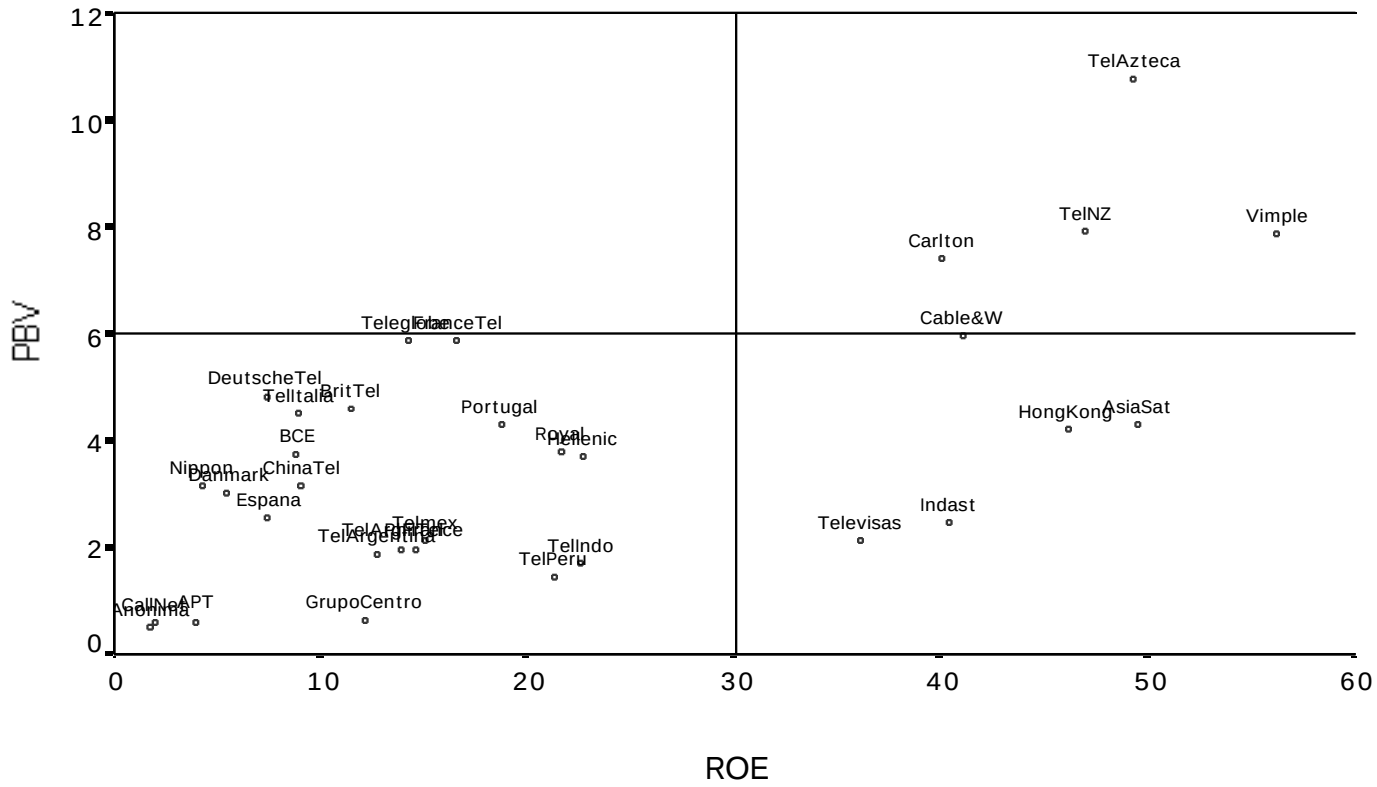
Large Market Cap Firms: PBV vs ROE: July 2000



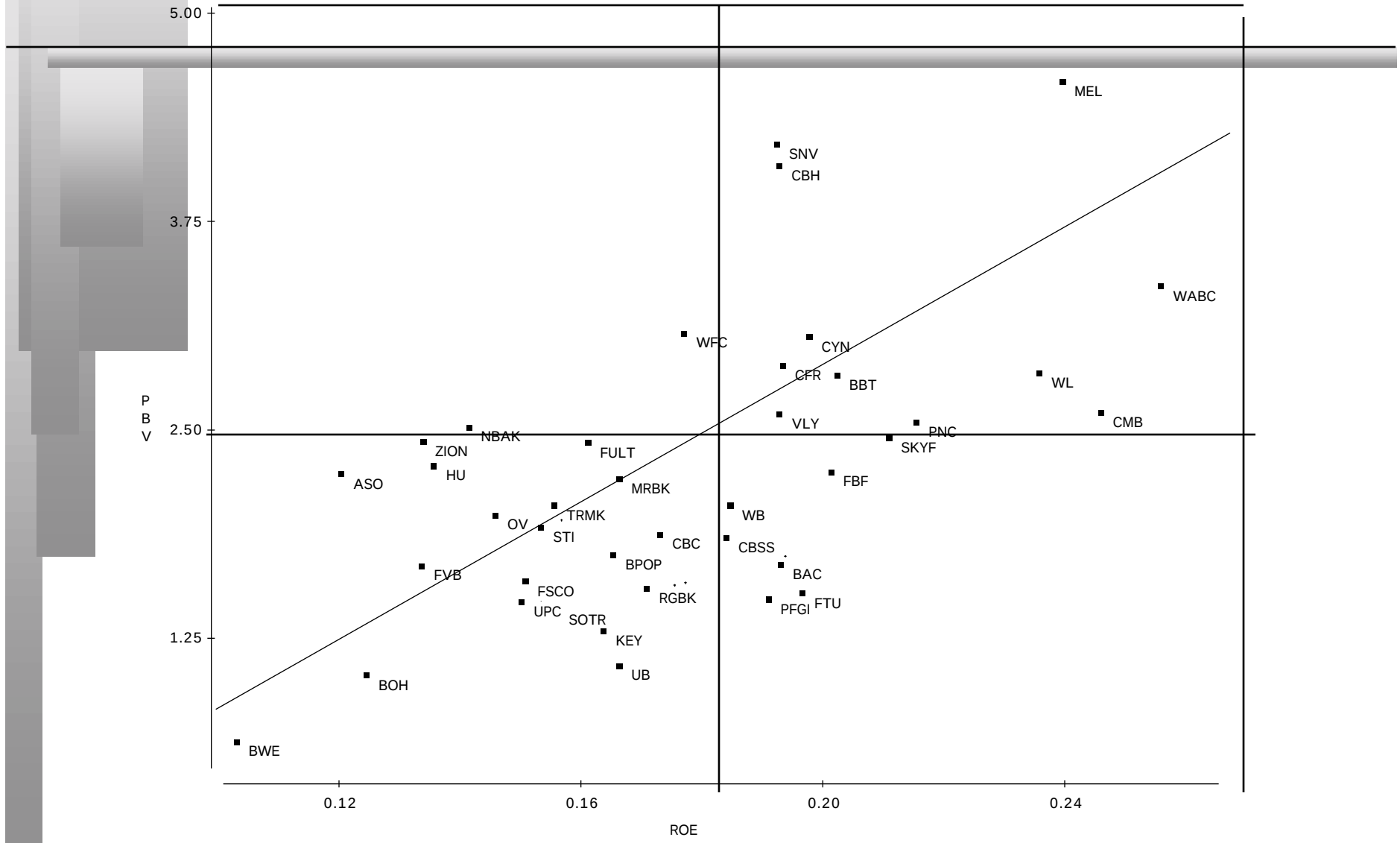
Company Symbols

Company Name	Ticker Symbol	Company Name	Ticker Symbol	Company Name	Ticker Symbol	Company Name	Ticker Symbol
Matsushita Elec. ADR	MC	British Telecom ADR	BTY	Merrill Lynch & Co.	MER	Int'l Business Mach.	IBM
Compaq Computer	CPQ	Amer. Int'l Group	AIG	Fannie Mae	FNM	Abbott Labs.	ABT
News Corp. Ltd. ADR	NWS	Chevron Corp.	CHV	Tyco Int'l Ltd.	TYC	Morgan S. Dean Witter	MWD
AT&T Corp.	T	AEGON Ins. Group	AEG	Amer. Express	AXP	Amgen	AMGN
Schlumberger Ltd.	SLB	Sprint Corp.	FON	Corning Inc.	GLW	Dell Computer	DELL
Disney (Walt)	DIS	Boeing	BA	EMC Corp.	EMC	Amer. Home Products	AHP
Koninklijke Philips NV	PHG	Hewlett-Packard	HWP	Gen'l Electric	GE	Procter & Gamble	PG
Time Warner	TWX	Banco Bilbao Vis. ADR	BBV	Intel Corp.	INTC	Pfizer, Inc.	PFE
Deutsche Telekom ADR	DT	Wells Fargo	WFC	Ford Motor	F	Schering-Plough	SGP
WorldCom Inc.	WCOM	Ericsson ADR	ERICY	BellSouth Corp.	BLS	Merck & Co.	MRK
Motorola, Inc.	MOT	Texas Instruments	TXN	Johnson & Johnson	JNJ	Bristol-Myers Squibb	BMY
Telefonica SA ADR	TEF	Micron Technology	MU	Lucent Technologies	LU	Philip Morris	MO
Banco Santander ADR	STD	Bank of America	BAC	PepsiCo, Inc.	PEP	Lilly (Eli)	LLY
Sony Corp. ADR	SNE	Home Depot	HD	Cisco Systems	CSCO	Oracle Corp.	ORCL
Exxon Mobil Corp.	XOM	McDonald's Corp.	MCD	Goldman Sachs	GS		
Aventis ADR	AVE	SBC Communications	SBC	Medtronic, Inc.	MDT		
Enron Corp.	ENE	Wal-Mart Stores	WMT	Sun Microsystems	SUNW		
Pharmacia Corp.	PHA	Du Pont	DD	Applied Materials	AMAT		
Shell Transport	SC	Citigroup Inc.	C	Schwab (Charles)	SCH		
Royal Dutch Petr.	RD	Qualcomm Inc.	QCOM	Microsoft Corp.	MSFT		
DaimlerChrysler AG	DCX	SmithKline Beecham	SBH	Nokia Corp. ADR	NOK		
BP Amoco ADR	BPA	Chase Manhattan Corp.	CMB	Coca-Cola	KO		

PBV Matrix: Telecom Companies

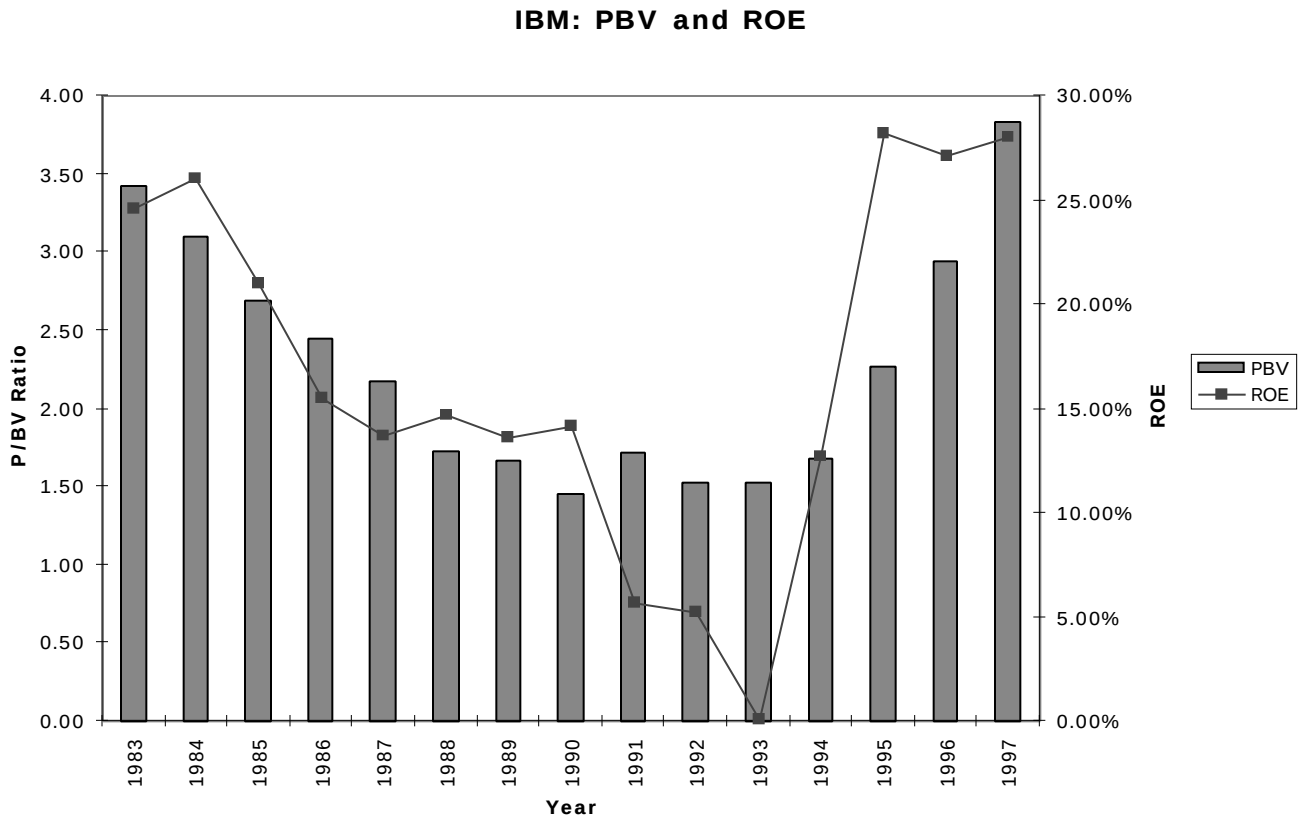


U.S. Banks: Market Cap > $ 1 billion



Company Name	*Ticker Symbol*	*Company Name*	*Ticker Symbol*	*Company Name*	*Ticker Symbol*
Westamerica Bancorp	WABC	Fulton Fin'l	FULT	Regions Financial	RGBK
Keystone Fin'l	KSTN	First Va. Banks	FVB	Synovus Financial	SNV
Colonial BncGrp. 'A'	CNB	City National Corp.	CYN	AmSouth Bancorp.	ASO
One Valley Bancorp	OV	Hibernia Corp. `A'	HIB	KeyCorp	KEY
National BanCorp. of Alaska,In	NBAK	Silicon Valley Bncsh	SIVB	BB&T Corp.	BBT
BancWest Corp.	BWE	Mercantile Bankshares	MRBK	Wachovia Corp.	WB
Hudson United Bancorp	HU	Compass Bancshares	CBSS	PNC Financial Serv.	PNC
Provident Finl Group	PFGI	Popular Inc	BPOP	SunTrust Banks	STI
Pacific Century Fin'l	BOH	First Security	FSCO	State Street Corp.	STT
Centura Banks	CBC	No. Fork Bancorp	NFB	Mellon Financial Corp.	MEL
Trustmark Corp.	TRMK	Natl Commerce Bancrp	NCBC	Morgan (J.P.) & Co	JPM
Sky Finl Group Inc	SKYF	UnionBancal Corp	UB	First Union Corp.	FTU
Wilmington Trust	WL	M&T Bank Corp.	MTB	FleetBoston Fin'l	FBF
Valley Natl Bancp NJ	VLY	Zions Bancorp.	ZION	Bank of New York	BK
Commerce Bancorp NJ	CBH	Union Planters	UPC	Chase Manhattan Corp.	CMB
Cullen/Frost Bankers	CFR	SouthTrust Corp.	SOTR	Wells Fargo	WFC
		Summit Bancorp	SUB	Bank of America	BAC

IBM: The Rise and Fall



PBV Ratio Regression

Dependent variable is: **AdjPBV**
No Selector
5903 total cases of which 3332 are missing
R squared = •% R squared (adjusted) = •%
s = 2.240 with 2571 - 4 = 2567 degrees of freedom

R squared = 46%

Source	Sum of Squares	df	Mean Square	F-ratio
Regression	30502.9	4	7625.73	1519
Residual	12885.7	2567	5.01977	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Exp Growt...	8.97383	0.4376	20.5	≤ 0.0001
Beta	0.854662	0.1035	8.26	≤ 0.0001
Payout Ra...	-0.051989	0.1335	-0.390	0.6969
ROE	4.96796	0.2109	23.6	≤ 0.0001

Cross Sectional Regression for Greece: June 1999

- Using data obtained from Bloomberg for 199 Greek companies, we ran the regression of PBV ratios against returns on equity and obtained the following:

PBV = 2.56 + 24.00 ROE R^2 = 45.37%

(4.19) (12.82)

- For instance, the predicted PBV ratios for the following companies would be:

Company	*Actual PBV*	*ROE*	*Predicted PBV*
Alpha Fin.	14.87	47%	2.56 + 24(.47)= 13.84
Girakian	2.36	1%	2.56 + 24(.01)= 2.80
Titan Cement	5.98	33%	2.56 + 24(.33)= 10.56
Michaniki	1.72	13%	2.56 + 24(.13)= 5.68

Price Sales Ratio: Definition

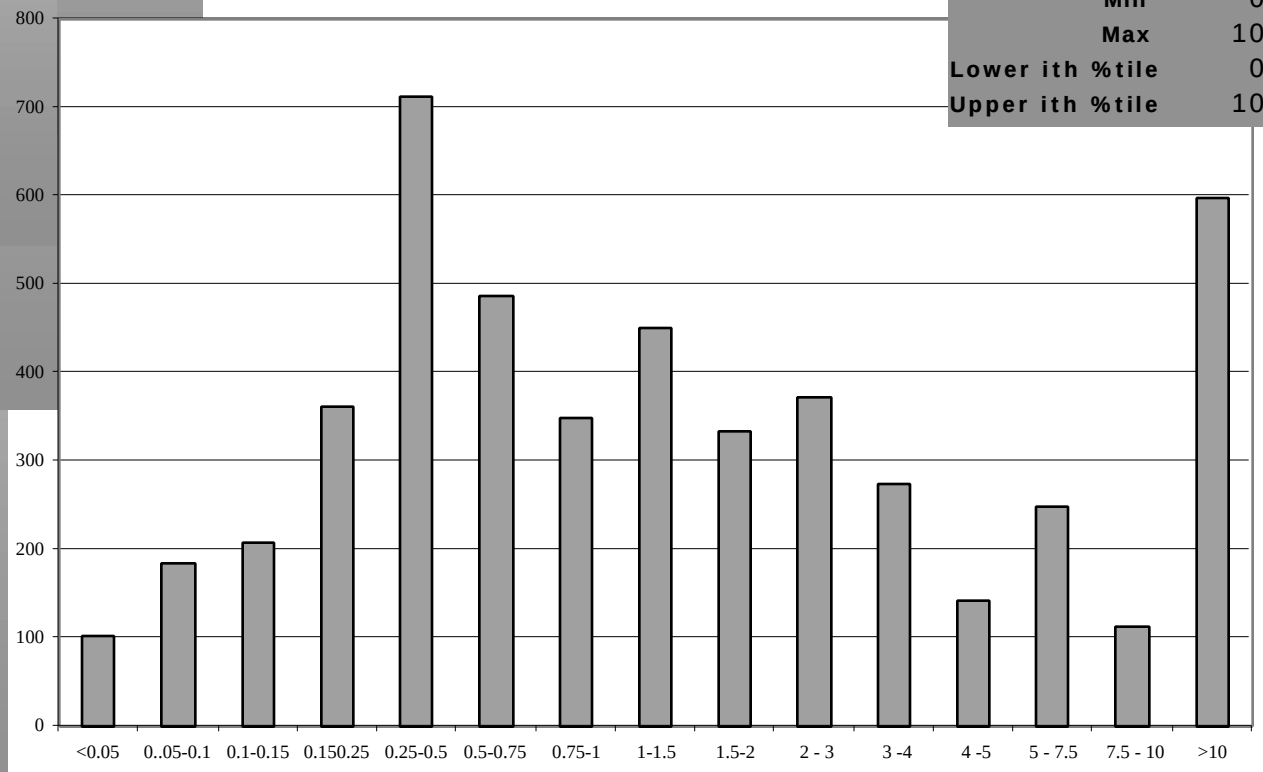
- The price/sales ratio is the ratio of the market value of equity to the sales.
- Price/ Sales= $\frac{\text{Market Value of Equity}}{\text{Total Revenues}}$
- Consistency Tests
  - The price/sales ratio is internally inconsistent, since the market value of equity is divided by the total revenues of the firm.

Price/Sales Ratio: Cross Sectional Distribution

Summary of **Price/Sales**
No Selector
5941 total cases of which 1023 are missing

Percentile 5

Count	4918
Mean	2.51810
Median	1.03579
StdDev	3.16625
Min	0.001524
Max	10
Lower ith %tile	0.105026
Upper ith %tile	10



Price/Sales Ratio: Determinants

- The price/sales ratio of a stable growth firm can be estimated beginning with a 2-stage equity valuation model:

$$P_0 = \frac{DPS_1}{r - g_n}$$

- Dividing both sides by the sales per share:

$$\frac{P_0}{Sales_0} = PS = \frac{\text{Net Profit Margin} * \text{Payout Ratio} * (1 + g_n)}{r - g_n}$$

PS/Margins: Brazilian Consumer Products

Company	*PS Ratio*	*Net Margin*
Lojas Arapua	0.01	-14.24%
Borghoff	0.03	-25.93%
Grazziotin	0.09	5.86%
Panvel	0.11	2.45%
Cia Alimentos	0.11	-12.47%
Bombril	0.13	3.32%
Makro Atacadista	0.15	1.30%
Lojas Americanas	0.18	-1.99%
IND Bebidas Antac	0.55	4.86%
Cia Antarctica	0.57	2.69%
Lojas Renner	0.62	9.25%
Tehnos Relogios	0.83	28.05%
Casa Anglo	1.04	2.30%
Souza Cruz	1.29	20.85%
Ind bebidas Antarc Polar	1.73	37.99%
Brahma	1.80	16.42%

Price/Sales Ratio: Is DHB cheap?

- Based upon the price/sales ratios, the cheap firms are Borghoff and Lojas Arapua. The expensive firms are firms like Souza Cruz and Brahma. Do you agree?
  - Yes
  - No
- If not, what might explain why there are such big differences across these firms?

Regression Results: PS Ratios and Margins

- Regressing PS ratios against net margins,

  PS = 0.43 + 2.93 (Net Margin) R^2 = 59.29%

- Thus, a 1% increase in the margin results in an increase of 0.03 in the price sales ratios.
- The regression also allows us to get predicted PS ratios for these firms

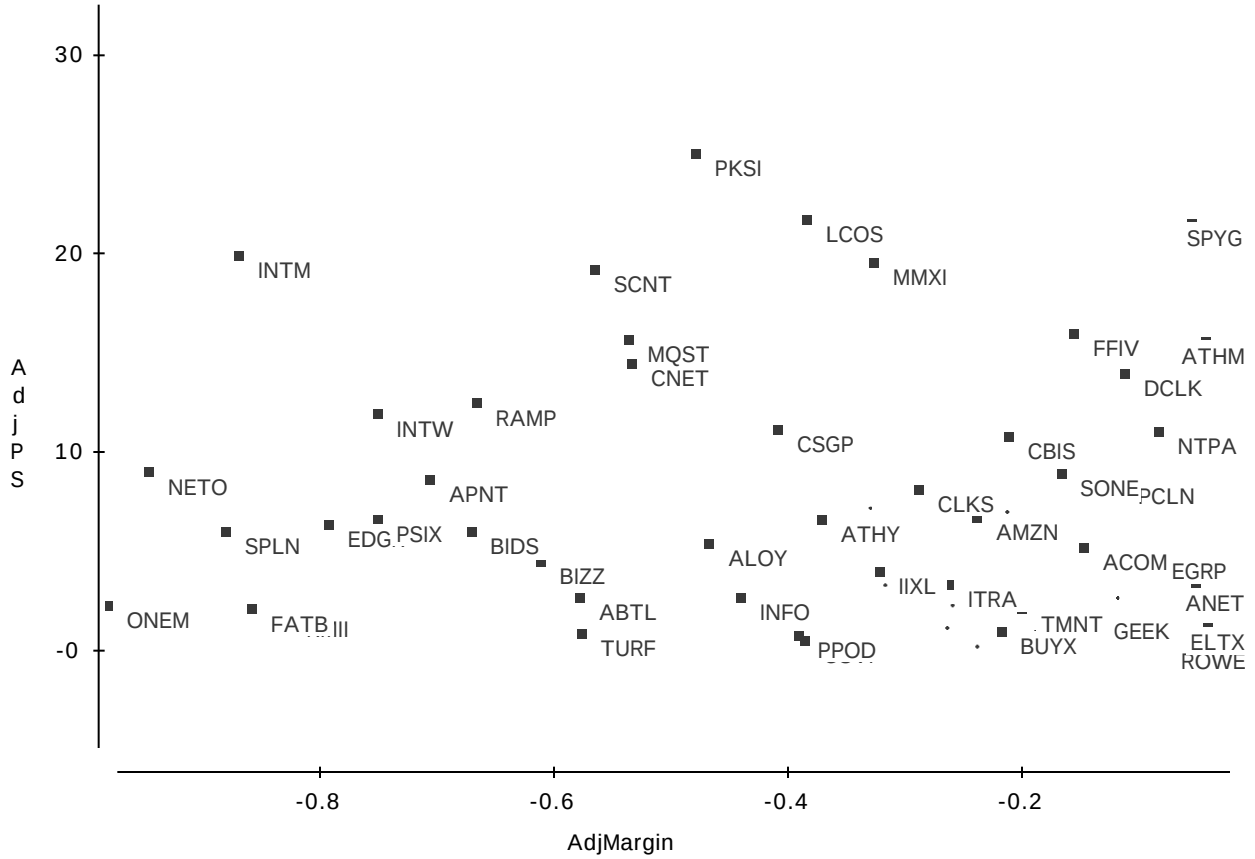
PS Ratios: Actual versus Predicted Values

Company	*PS Ratio*	*Net Margin*	*Predicted PS*	*Under or Over Valued*
Lojas Arapua	0.0103	-14.24%	0.0128	-19.74%
Borghoff	0.0283	-25.93%	NA	NA
Grazziotin	0.0918	5.86%	0.6017	-84.74%
Panvel	0.1116	2.45%	0.5019	-77.76%
Cia Alimentos	0.1135	-12.47%	0.0646	75.75%
Bombril	0.1317	3.32%	0.5273	-75.03%
Makro Atacadista	0.1528	1.30%	0.4681	-67.35%
Lojas Americanas	0.1823	-1.99%	0.3717	-50.96%
IND Bebidas Antac	0.5513	4.86%	0.5723	-3.67%
Cia Antarctica	0.5700	2.69%	0.5088	12.03%
Lojas Renner	0.6240	9.25%	0.7010	-11.00%
Tehnos Relogios	0.8250	28.05%	1.2518	-34.09%
Casa Anglo	1.0384	2.30%	0.4973	108.80%
Souza Cruz	1.2864	20.85%	1.0408	23.60%
Ind bebidas Antarc Polar	1.7257	37.99%	1.5431	11.83%
Brahma	1.8027	16.42%	0.9110	97.87%

Current versus Predicted Margins

- One of the limitations of the analysis we did in these last few pages is the focus on current margins. Stocks are priced based upon expected margins rather than current margins.
- For most firms, current margins and predicted margins are highly correlated, making the analysis still relevant.
- For firms where current margins have little or no correlation with expected margins, regressions of price to sales ratios against current margins (or price to book against current return on equity) will not provide much explanatory power.
- In these cases, it makes more sense to run the regression using either predicted margins or some proxy for predicted margins.

A Case Study: The Internet Stocks



PS Ratios and Margins are not highly correlated

- Regressing PS ratios against current margins yields the following

  PS = 81.36 - 7.54(Net Margin) R^2 = 0.04

  (0.49)

- This is not surprising. These firms are priced based upon expected margins, rather than current margins. Hypothesizing that firms with higher revenue growth and higher cash balances should have a greater chance of surviving and becoming profitable, we ran the following regression: (The level of revenues was used to control for size)

PS = 30.61 - 2.77 ln(Rev) + 6.42 (Rev Growth) + 5.11 (Cash/Rev)

(0.66) (2.63) (3.49)

R squared = 31.8%

Predicted PS = 30.61 - 2.77(7.1039) + 6.42(1.9946) + 5.11 (.3069) = 30.42

Actual PS = 25.63

Stock is undervalued, relative to other internet stocks.

PS Regression

Dependent variable is: **AdjPSRatio**
No Selector
5903 total cases of which 3655 are missing **R squared = 52%**
R squared = •% R squared (adjusted) = •%
s = 1.849 with 2248 - 4 = 2244 degrees of freedom

Source	Sum of Squares	df	Mean Square	F-ratio
Regression	14960.1	4	3740.03	1094
Residual	7670.48	2244	3.41822	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
AdjMgn	16.1747	0.5129	31.5	≤ 0.0001
Exp Growth: E...	7.60241	0.3801	20.0	≤ 0.0001
Beta	-0.444203	0.0918	-4.84	≤ 0.0001
Payout Ratio	-0.585029	0.1147	-5.10	≤ 0.0001

Choosing Between the Multiples

- As presented in this section, there are dozens of multiples that can be potentially used to value an individual firm.
- In addition, relative valuation can be relative to a sector (or comparable firms) or to the entire market (using the regressions, for instance)
- Since there can be only one final estimate of value, there are three choices at this stage:
  - Use a simple average of the valuations obtained using a number of different multiples
  - Use a weighted average of the valuations obtained using a nmber of different multiples
  - Choose one of the multiples and base your valuation on that multiple

Picking one Multiple

- This is usually the best way to approach this issue. While a range of values can be obtained from a number of multiples, the "best estimate" value is obtained using one multiple.
- The multiple that is used can be chosen in one of two ways:
  - Use the multiple that best fits your objective. Thus, if you want the company to be undervalued, you pick the multiple that yields the highest value.
  - Use the multiple that has the highest R-squared in the sector when regressed against fundamentals. Thus, if you have tried PE, PBV, PS, etc. and run regressions of these multiples against fundamentals, use the multiple that works best at explaining differences across firms in that sector.
  - Use the multiple that seems to make the most sense for that sector, given how value is measured and created.

A More Intuitive Approach

- As a general rule of thumb, the following table provides a way of picking a multiple for a sector

Sector	*Multiple Used*	*Rationale*
Cyclical Manufacturing	PE, Relative PE	Often with normalized earnings
High Tech, High Growth	PEG	Big differences in growth across firms
High Growth/No Earnings	PS, VS	Assume future margins will be good
Heavy Infrastructure	VEBITDA	Firms in sector have losses in early years and reported earnings can vary depending on depreciation method
REITa	P/CF	Generally no cap ex investments from equity earnings
Financial Services	PBV	Book value often marked to market
Retailing	PS	If leverage is similar across firms
	VS	If leverage is different

Reviewing: The Four Steps to Understanding Multiples

- Define the multiple
  - Check for consistency
  - Make sure that they are estimated uniformally
- Describe the multiple
  - Multiples have skewed distributions: The averages are seldom good indicators of typical multiples
  - Check for bias, if the multiple cannot be estimated
- Analyze the multiple
  - Identify the companion variable that drives the multiple
  - Examine the nature of the relationship
- Apply the multiple