# Relative Valuation

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# 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

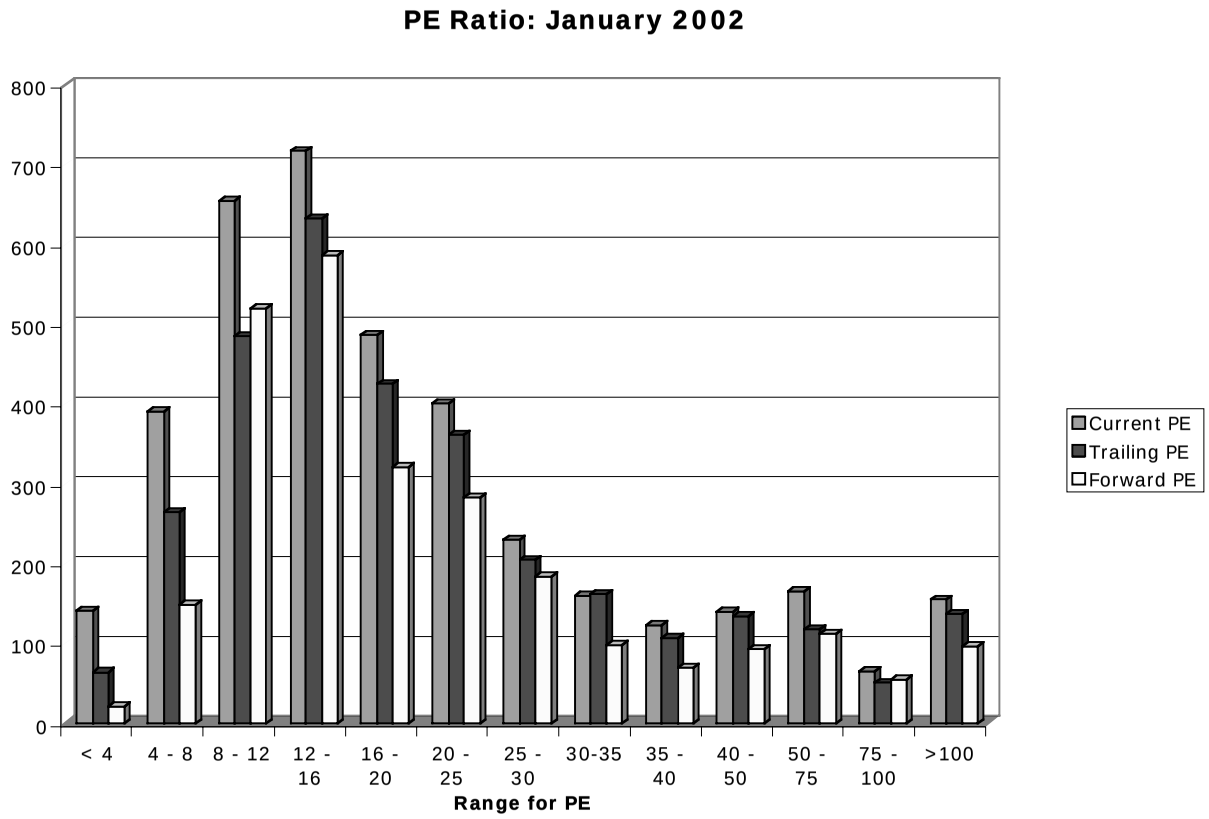
- Given the firm that we are valuing, what is a “comparable” firm?
  - While traditional analysis is built on the premise that firms in the same sector are comparable firms, valuation theory would suggest that a comparable firm is one which is similar to the one being analyzed in terms of fundamentals.
  - **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

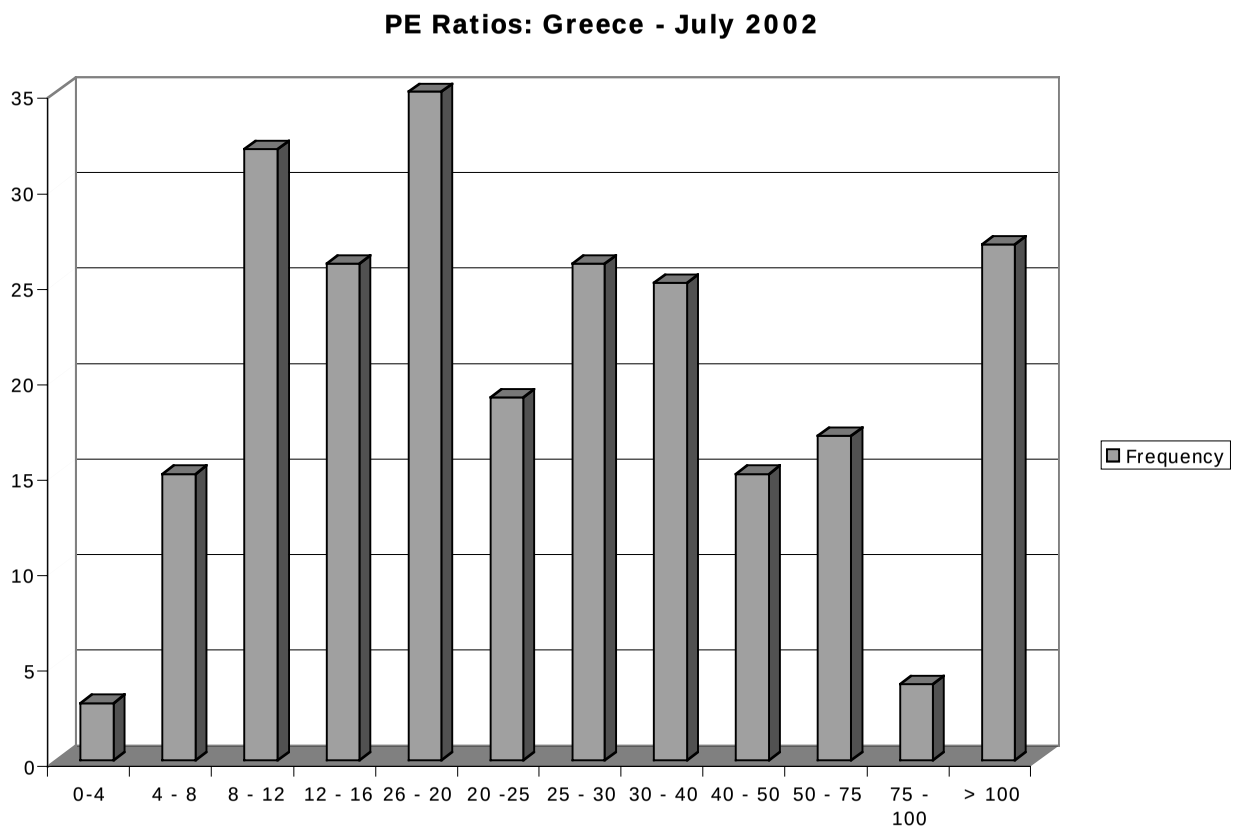
# PE Ratio: Descriptive Statistics for United States



# PE: Deciphering the Distribution

| | *Current PE* | *Trailing PE* | *Forward PE* |
|---|---|---|---|
| Mean | 45.74 | 33.59 | 29.13 |
| Standard Error | 8.42 | 1.72 | 1.10 |
| Median | 16.11 | 17.07 | 16.25 |
| Mode | 14.00 | 23.00 | 26.00 |
| Standard Deviation | 521.11 | 96.63 | 56.05 |
| Sample Variance | 271555.88 | 9336.95 | 3141.52 |
| Kurtosis | 2569.94 | 370.51 | 154.52 |
| Skewness | 47.60 | 15.76 | 10.40 |
| Range | 29156.82 | 3051.47 | 1210.78 |
| Minimum | 0.18 | 0.03 | 0.22 |
| Maximum | 29157.00 | 3051.50 | 1211.00 |
| Sum | 175282.79 | 105777.83 | 75450.54 |
| Count | 3832 | 3149 | 2590 |

# Greece: PE Ratios - July 2002



# 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:

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

  - 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:

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

# A Simple Example

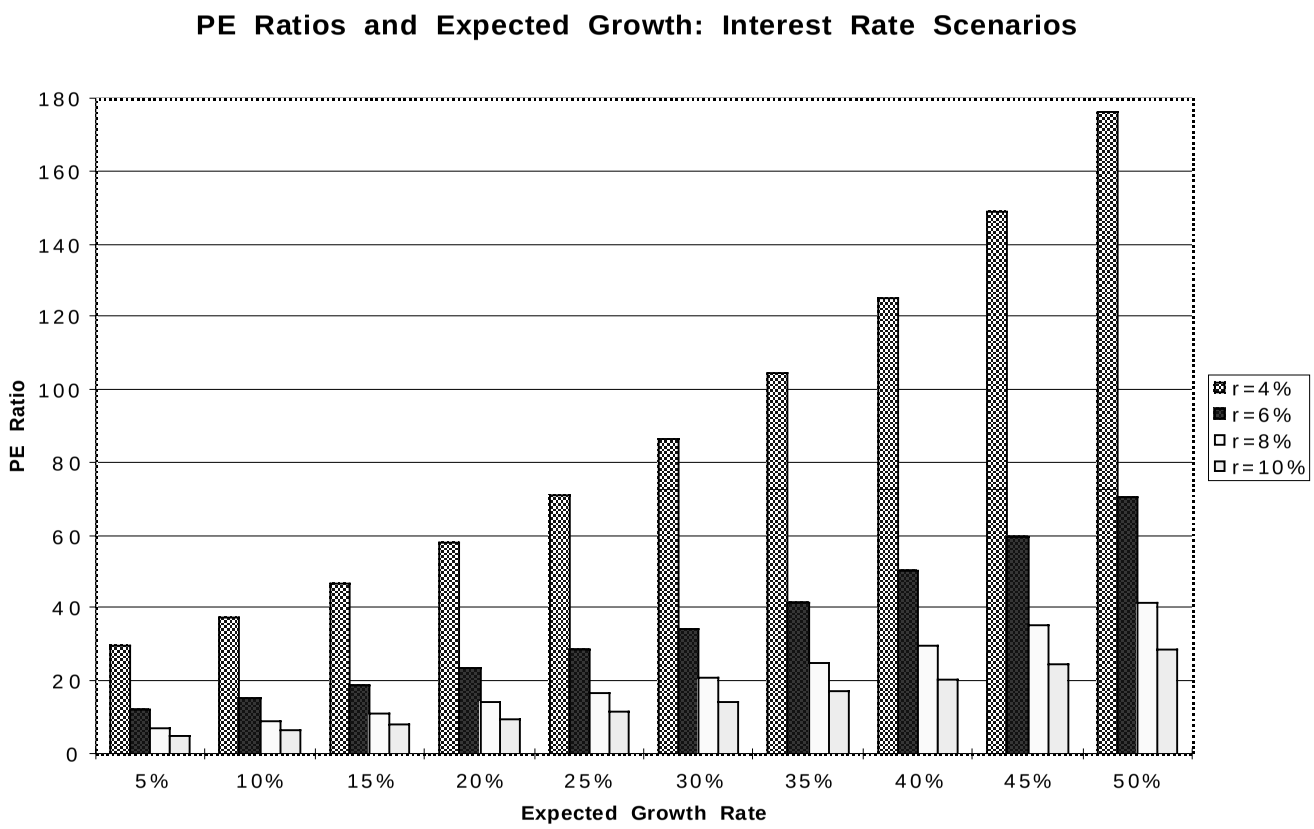
- Assume that you have been asked to estimate the PE ratio for a firm which has the following characteristics:

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

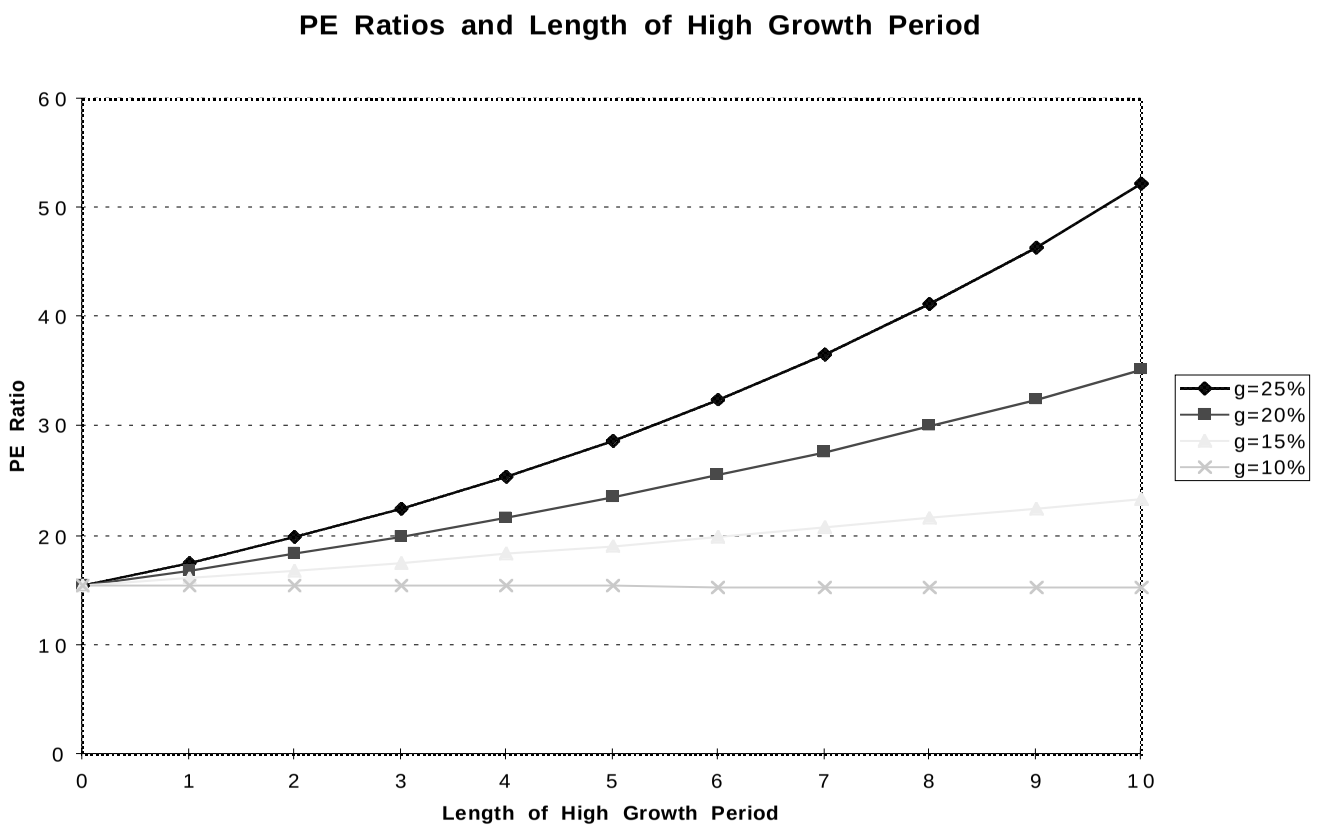
- Riskfree rate = T.Bond Rate = 6%
- Required rate of return = 6% + 1(5.5%)= 11.5%

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

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

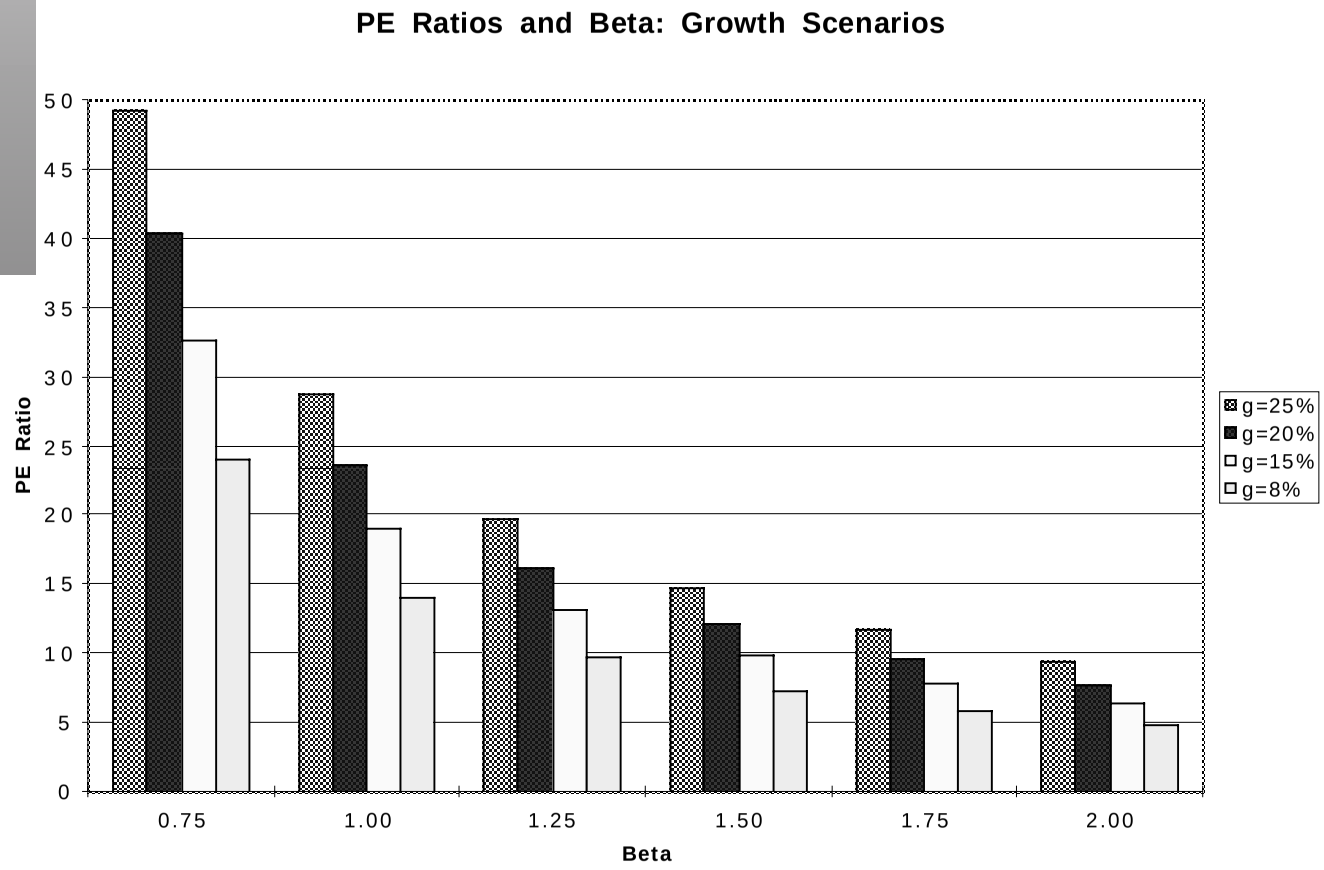


# PE Ratios and Length of High Growth: 25% growth for n years; 8% thereafter

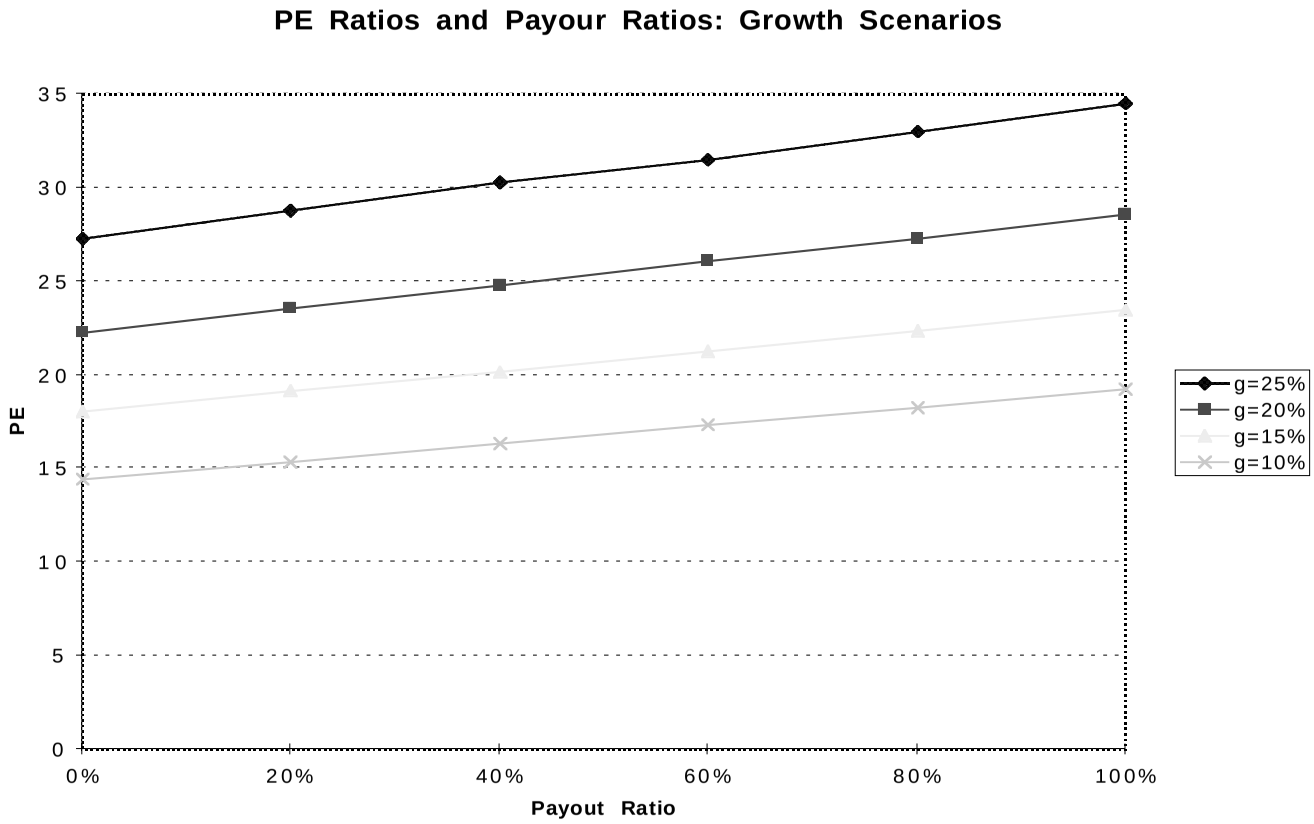


# PE and Risk: Effects of Changing Betas on PE Ratio:

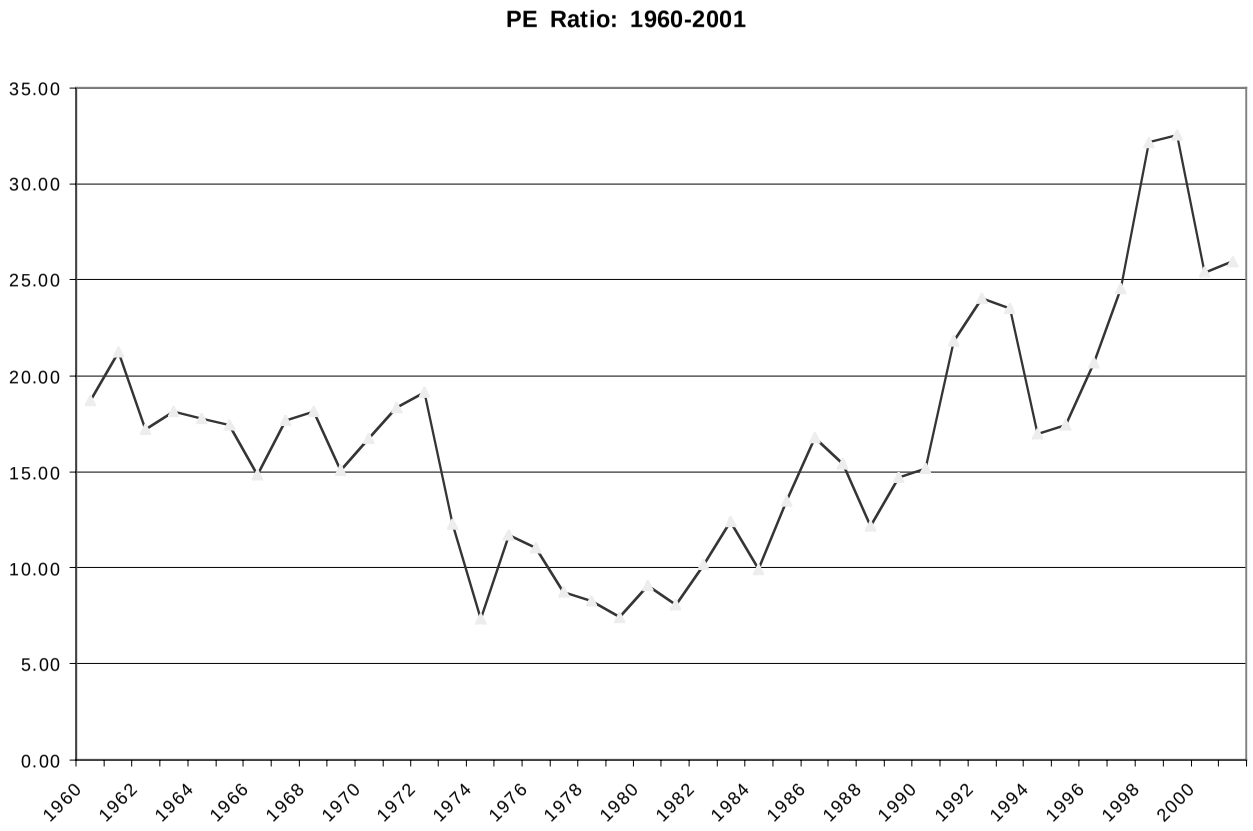
Firm with x% growth for 5 years; 8% thereafter



# PE and Payout



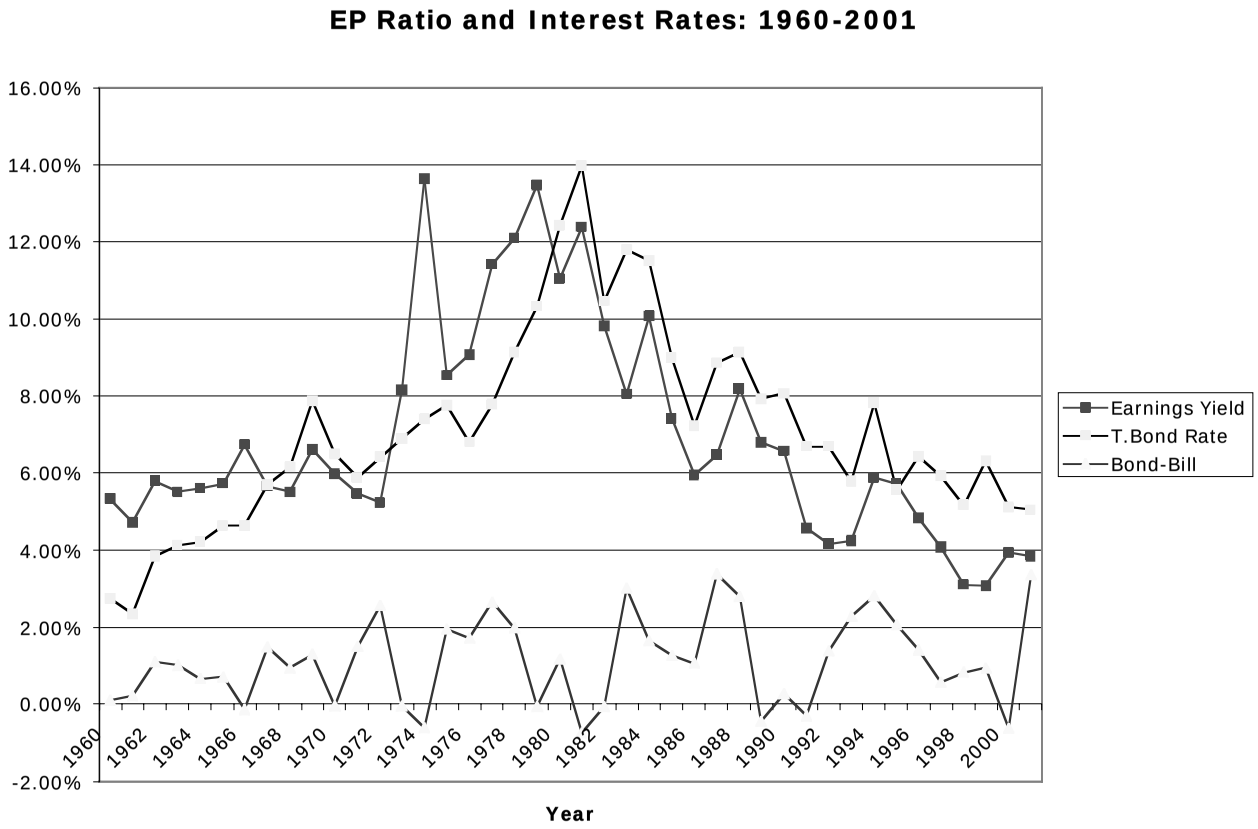
# Comparisons of PE across time



# 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 0.70 between the two variables.,
- In addition, there is evidence that the term structure also affects the PE ratio.
- In the following regression, using 1960-2001 data, we regress E/P ratios against the level of T.Bond rates and a term structure variable (T.Bond - T.Bill rate)

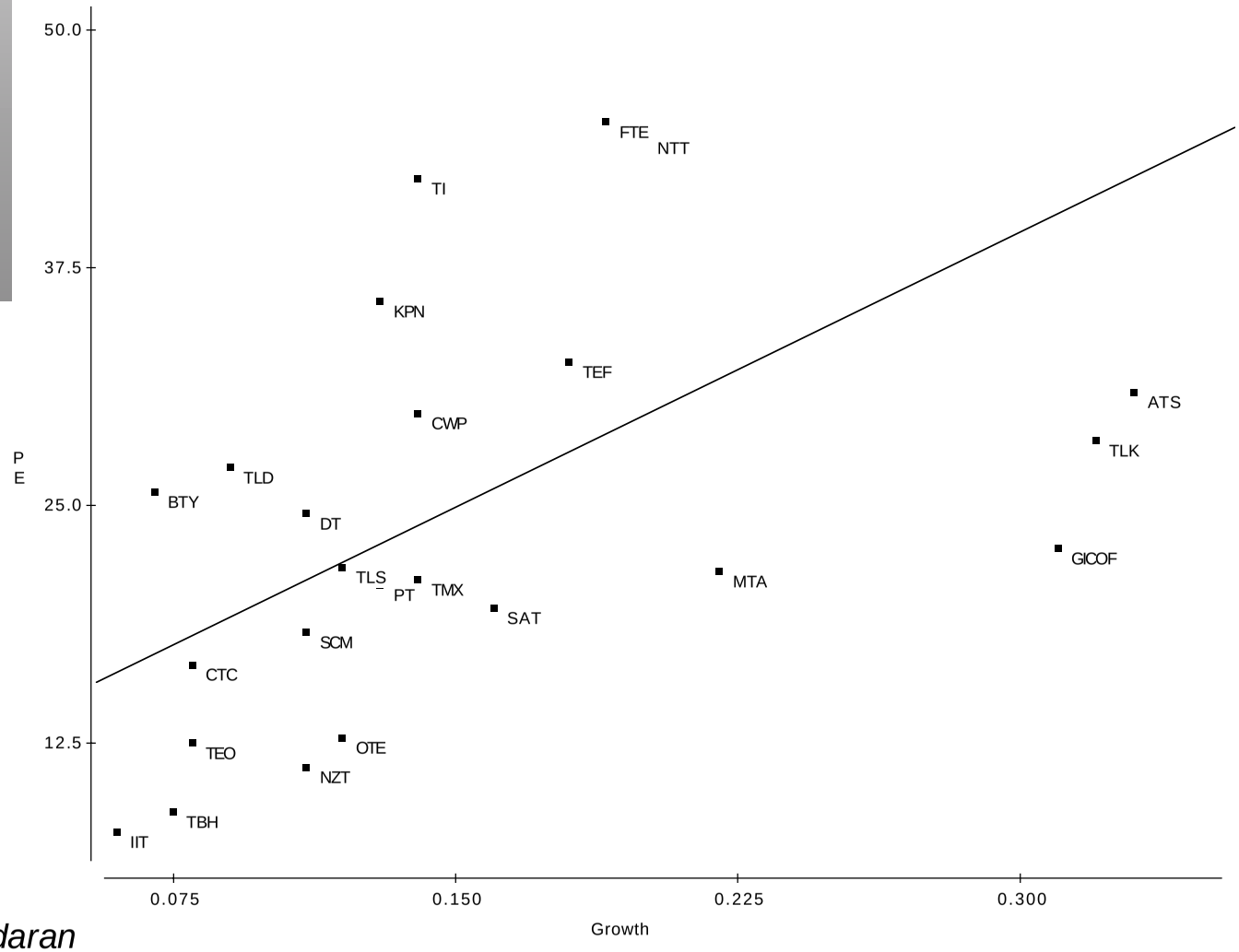
E/P = 1 .86% + 0.782 T.Bond Rate - 0.433 (T.Bond Rate-T.Bill Rate)
(1.94) (6.29) (-1.56)

R squared = 51%

# Comparing PE Ratios across a Sector

| 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

# Under or Over Valued

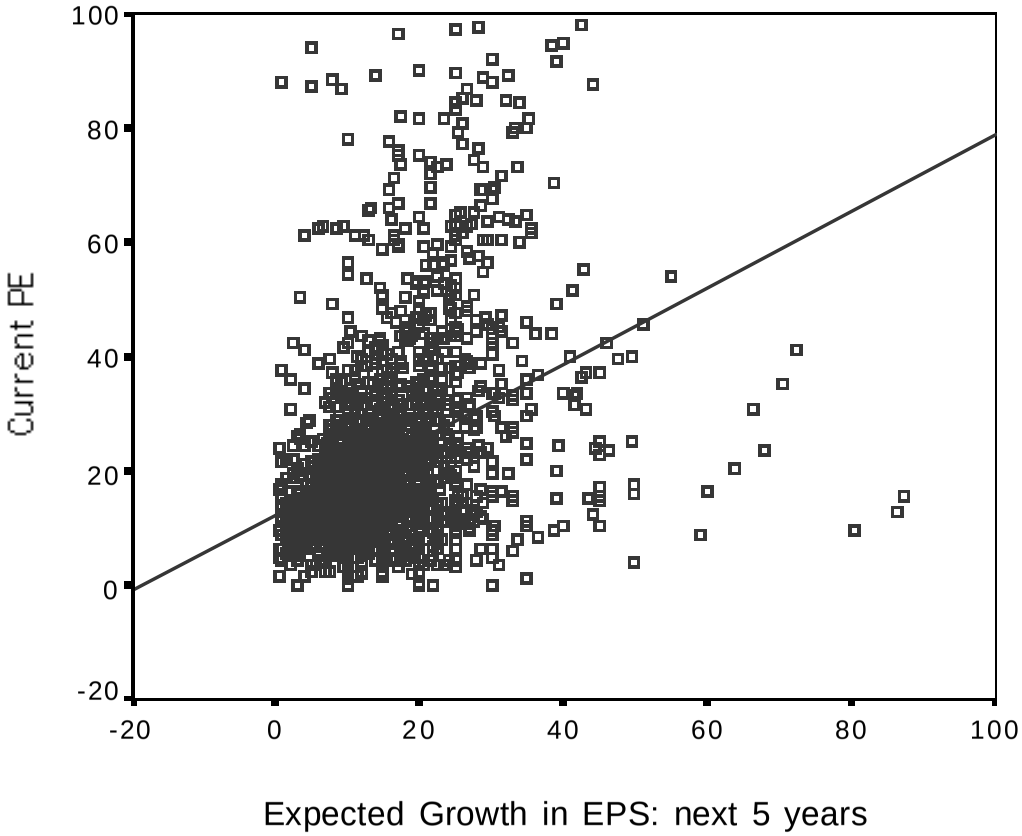
- Deutsche Telecom
  - Expected growth rate = 11%
  - Predicted PE = 13.12 + 121.22 (.11) - 13.85 (0) = 26.45
  - Actual PE = 24.6
- Telebras
  - Expected growth rate = 7.5%
  - Emerging market dummy = 1
  - Predicted PE = 13.12 + 121.22 (.075) - 13.85 (1) = 8.35
  - Actual PE = 8.90
- Hellenic Telecom
  - Expected growth rate = 12%
  - Predicted PE = 13.12 + 121.22 (.12) = 27.66
  - Actual PE = 12.8

  If viewed as emerging market telecom, predicted PE = 13.81

# 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

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .488[a] | .238 | .237 | 964.588609 |

a. Predictors: (Constant), Payout Ratio, Expected Growth in EPS: next 5 years, BETA

**Coefficients[a,b]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Correlations | | |
|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Zero-order | Partial | Part |
| 1 | (Constant) | 8.059 | 1.262 | | 6.387 | .000 | | | |
| | Expected Growth in EPS: next 5 years | 1.003 | .042 | .482 | 23.681 | .000 | .480 | .466 | .459 |
| | BETA | 3.110 | .921 | .073 | 3.378 | .001 | .164 | .075 | .066 |
| | Payout Ratio | 5.115E-02 | .014 | .081 | 3.788 | .000 | -.070 | .084 | .073 |

a. Dependent Variable: Current PE

b. Weighted Least Squares Regression - Weighted by Market Cap

# The Multicollinearity Problem

**Correlations**

| | | Current PE | Expected Growth in EPS: next 5 y | Beta | Payout Ratio |
|---|---|---|---|---|---|
| Current PE | Pearson Correlation | 1.000 | .342* | .130* | .009 |
| | Sig. (2-tailed) | . | .000 | .000 | .594 |
| | N | 3303 | 2085 | 3027 | 3290 |
| Expected Growth in EPS: next 5 y | Pearson Correlation | .342* | 1.000 | .397* | -.078* |
| | Sig. (2-tailed) | .000 | . | .000 | .000 |
| | N | 2085 | 2675 | 2393 | 2143 |
| Beta | Pearson Correlation | .130* | .397* | 1.000 | -.213* |
| | Sig. (2-tailed) | .000 | .000 | . | .000 |
| | N | 3027 | 2393 | 4534 | 3114 |
| Payout Ratio | Pearson Correlation | .009 | -.078* | -.213* | 1.000 |
| | Sig. (2-tailed) | .594 | .000 | .000 | . |
| | N | 3290 | 2143 | 3114 | 3388 |

**. Correlation is significant at the 0.01 level (2-tailed).

# Using the PE ratio regression

- Assume that you were given the following information for Dell. The firm has an expected growth rate of 10%, 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 18 times earnings. What does the predicted PE tell you?

# 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 Multiples: A Look at the Choices

- 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.

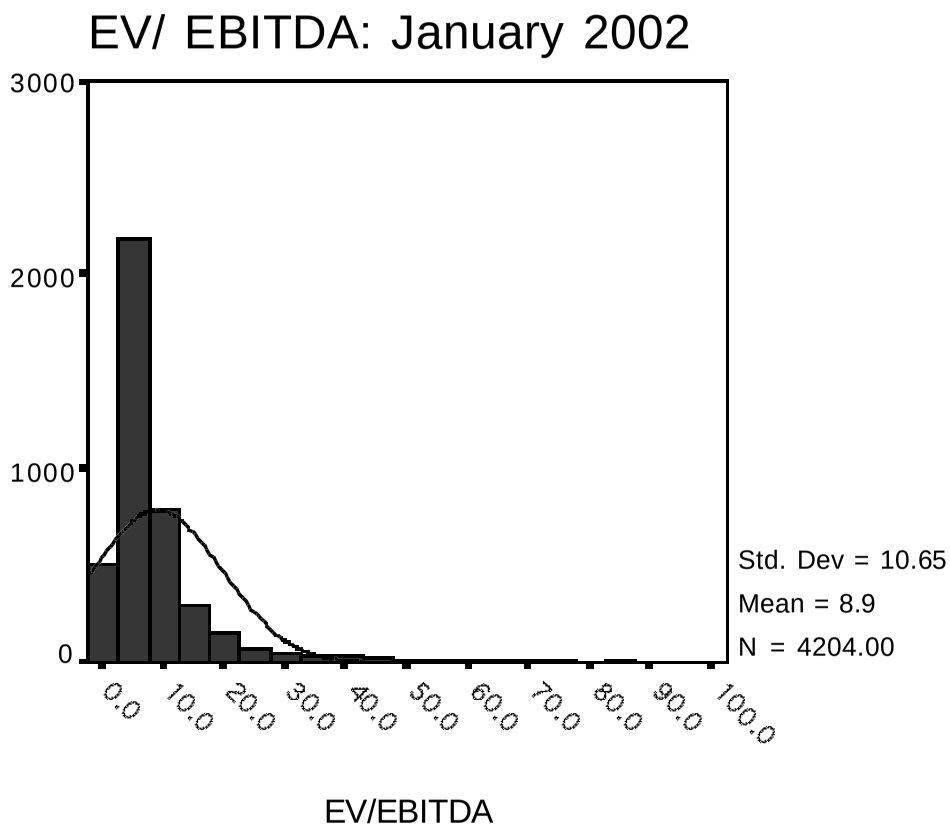
Free Cash Flow to the Firm

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

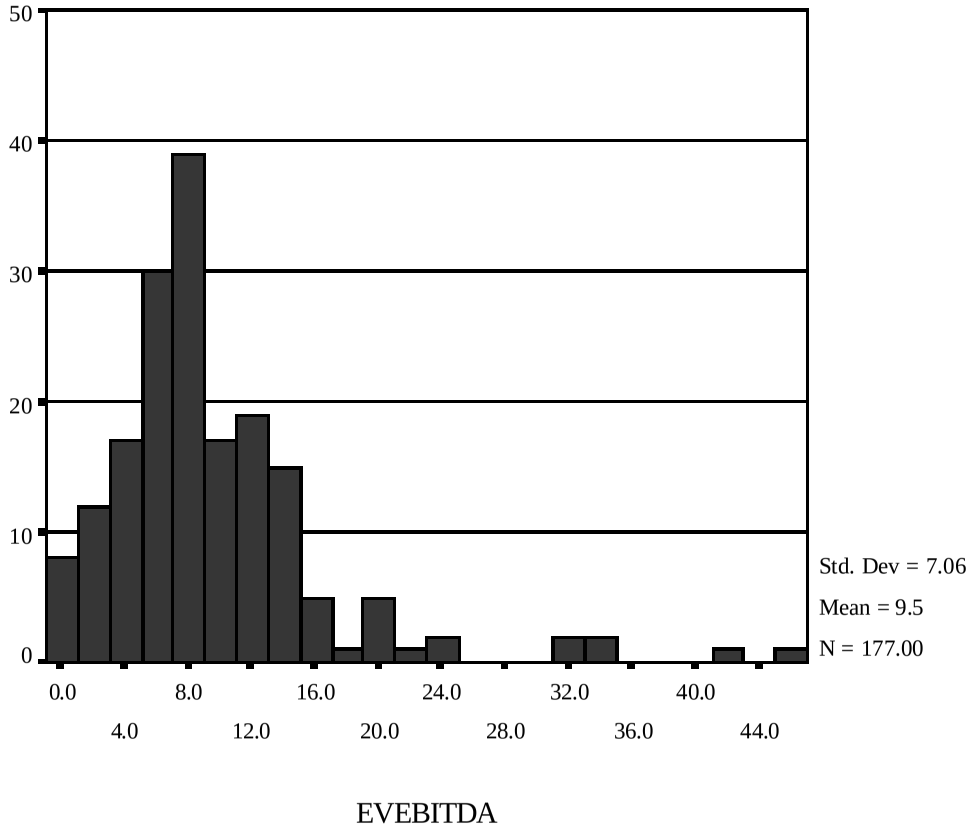
= 3356 (1 - 0.36) + 1100 - 2500 - 250 = $ 498 million

| | *$ 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 Distribution: US



# Value/EBITDA - Greece in July 2002



# 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)]

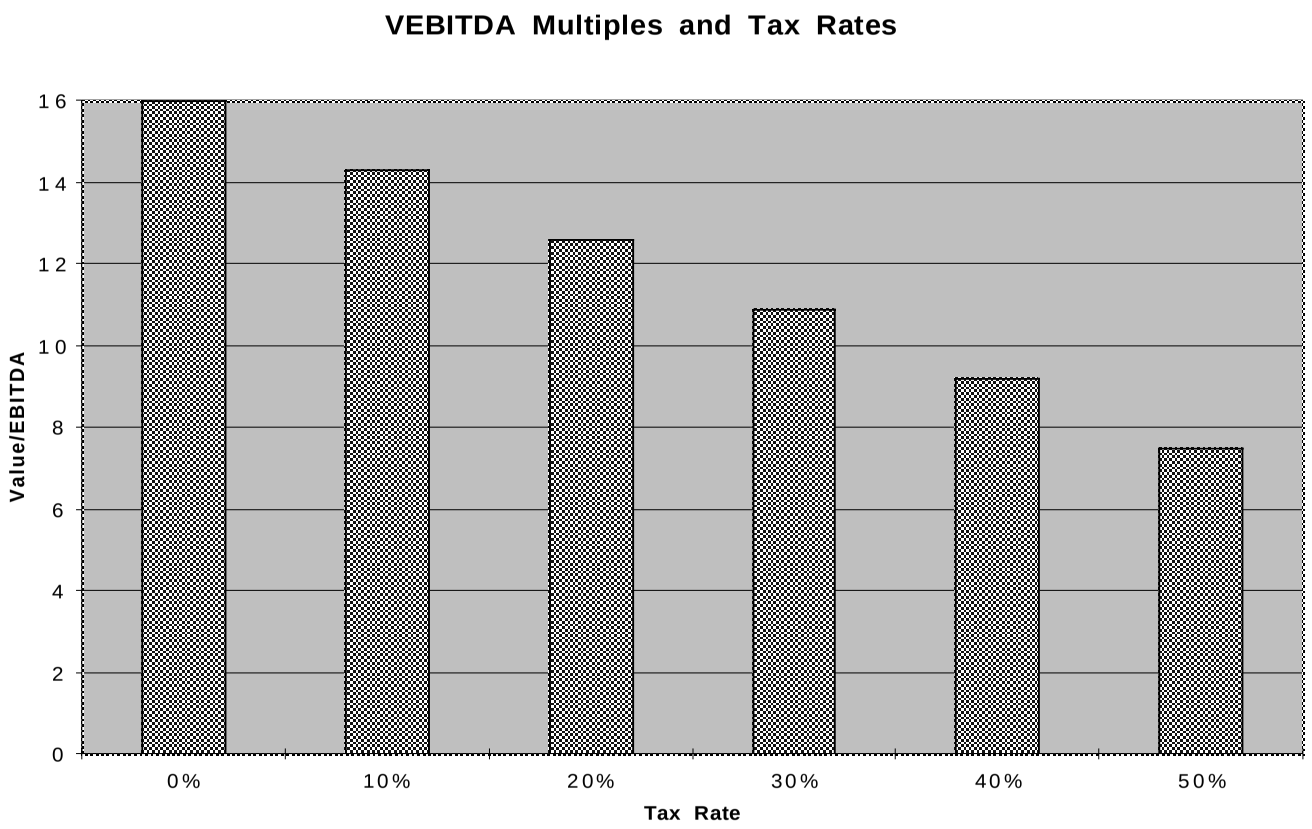
  Solving for ROC, ROC = 25.60%

# Calculating Value/EBITDA Multiple

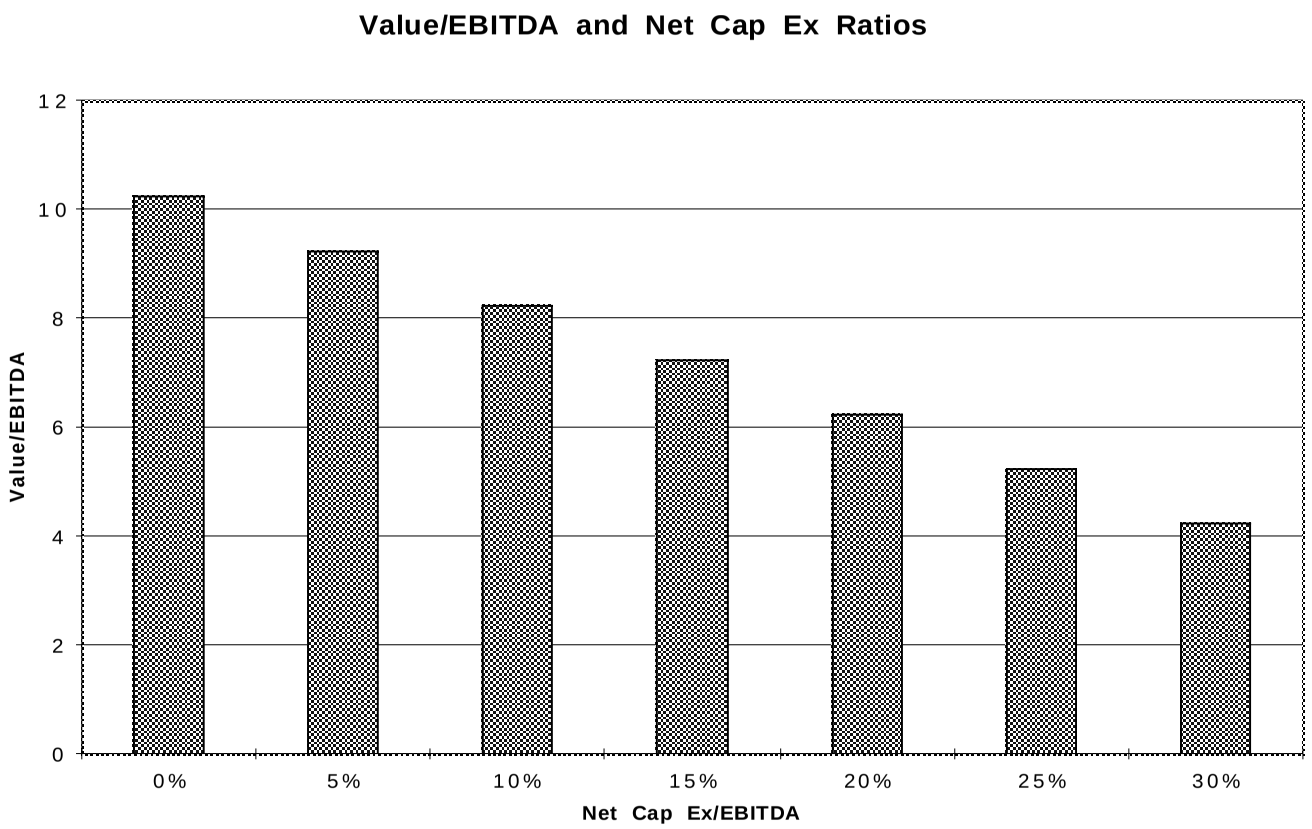
- In this case, the Value/EBITDA multiple for this firm can be estimated as follows:

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

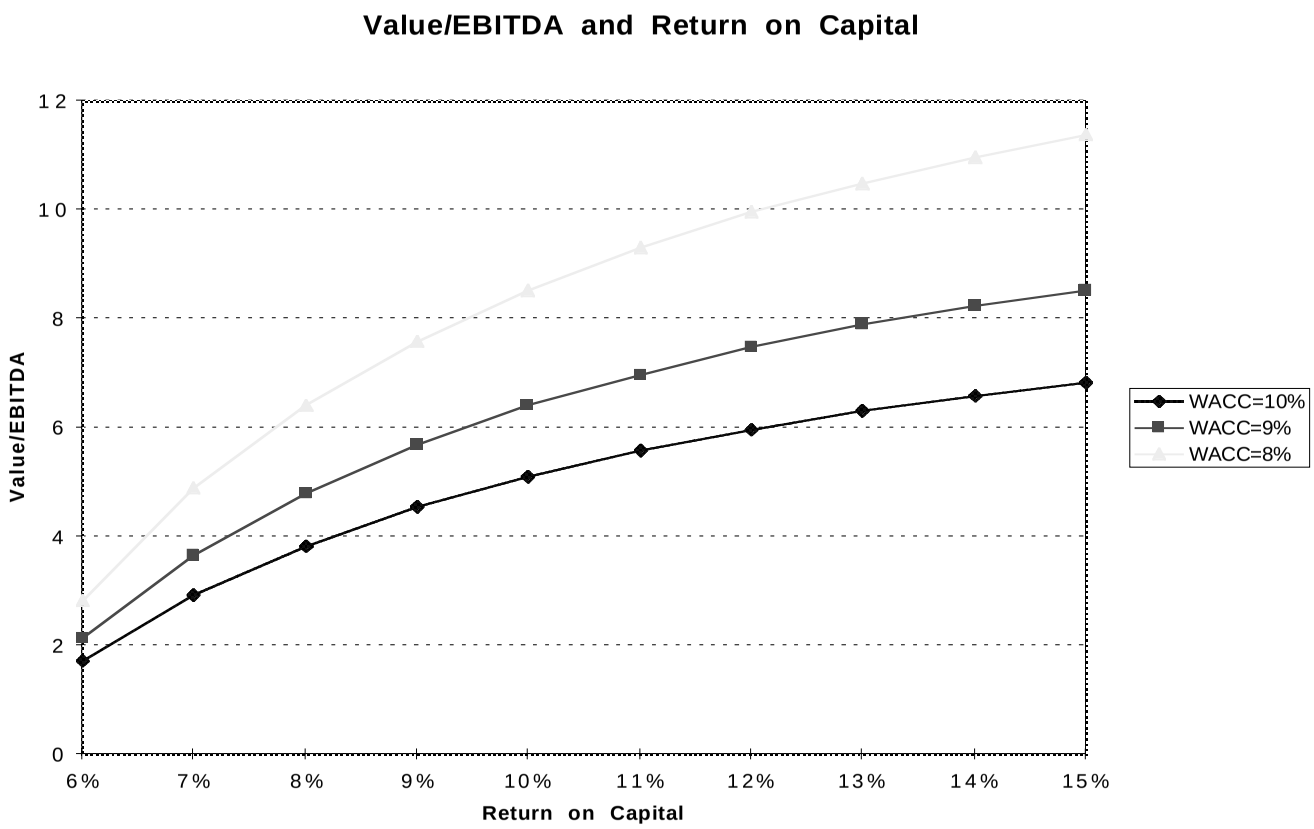
# Value/EBITDA Multiples and Taxes



# 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)

# Europe: Cross Sectional Regression

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .629[a] | .395 | .385 | 444.9598 |

**Coefficients[a,b]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 7.342 | 2.215 | | 3.315 | .001 |
| | ROC | .229 | .032 | .447 | 7.054 | .000 |
| | TAX_RATE | -9.457E-02 | .047 | -.134 | -1.998 | .047 |
| | Volatility 90 Day | -2.573E-02 | .033 | -.045 | -.790 | .430 |
| | Geometric Growth-EPS Before XO | .155 | .018 | .528 | 8.548 | .000 |

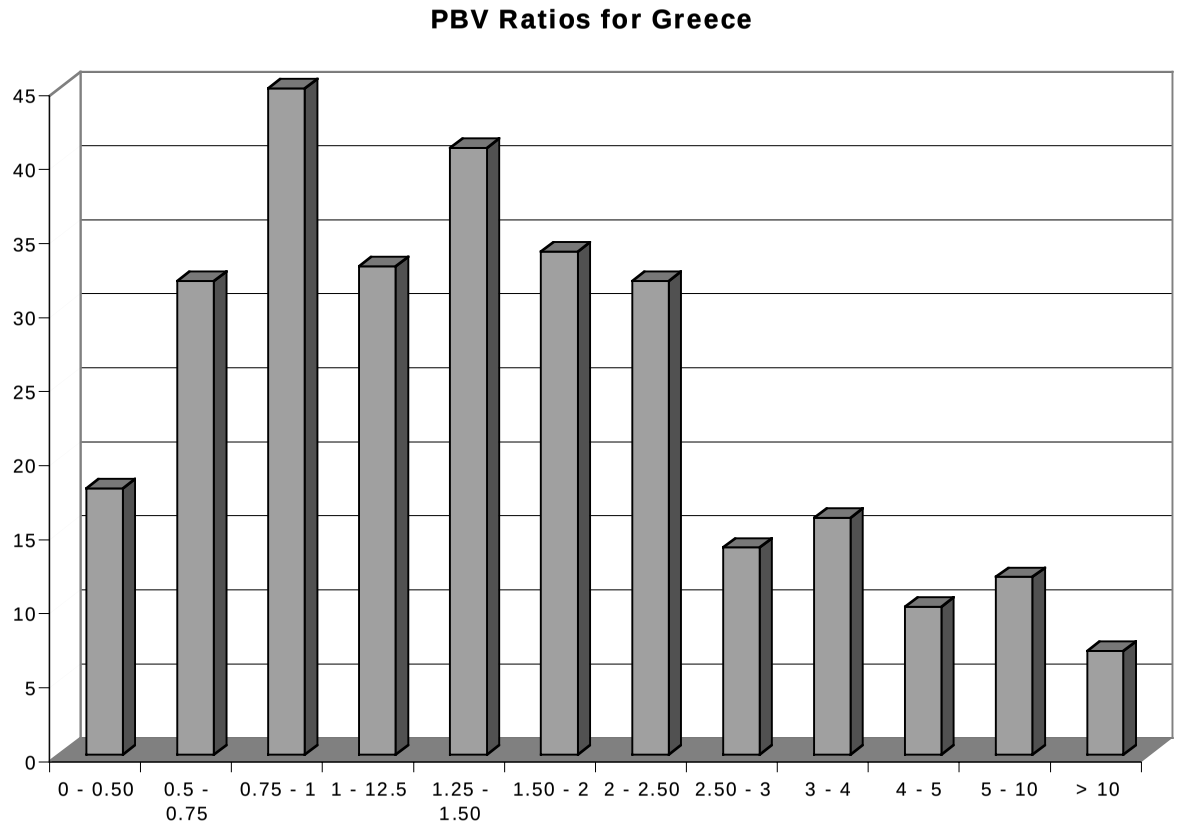
a. Dependent Variable: EV/EBITDA

b. Weighted Least Squares Regression - Weighted by Market Cap (millions)

# 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: Greece - July 2002



# 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:

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

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

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

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

# PBV/ROE: European Banks

| *Bank* | *Symbol* | *PBV* | *ROE* |
|---|---|---|---|
| Banca di Roma SpA | BAHQE | 0.60 | 4.15% |
| Commerzbank AG | COHSO | 0.74 | 5.49% |
| Bayerische Hypo und Vereinsbank AG | BAXWW | 0.82 | 5.39% |
| Intesa Bci SpA | BAEWF | 1.12 | 7.81% |
| Natexis Banques Populaires | NABQE | 1.12 | 7.38% |
| Almanij NV Algemene Mij voor Nijver | ALPK | 1.17 | 8.78% |
| Credit Industriel et Commercial | CIECM | 1.20 | 9.46% |
| Credit Lyonnais SA | CREV | 1.20 | 6.86% |
| BNL Banca Nazionale del Lavoro SpA | BAEXC | 1.22 | 12.43% |
| Banca Monte dei Paschi di Siena SpA | MOGG | 1.34 | 10.86% |
| **Deutsche Bank AG** | **DEMX** | **1.36** | **17.33%** |
| Skandinaviska Enskilda Banken | SKHS | 1.39 | 16.33% |
| Nordea Bank AB | NORDEA | 1.40 | 13.69% |
| **DNB Holding ASA** | **DNHLD** | **1.42** | **16.78%** |
| ForeningsSparbanken AB | FOLG | 1.61 | 18.69% |
| Danske Bank AS | DANKAS | 1.66 | 19.09% |
| ***Credit Suisse Group*** | ***CRGAL*** | ***1.68*** | ***14.34%*** |
| KBC Bankverzekeringsholding | KBCBA | 1.69 | 30.85% |
| Societe Generale | SODI | 1.73 | 17.55% |
| ***Santander Central Hispano SA*** | ***BAZAB*** | ***1.83*** | ***11.01%*** |
| National Bank of Greece SA | NAGT | 1.87 | 26.19% |
| San Paolo IMI SpA | SAOEL | 1.88 | 16.57% |
| BNP Paribas | BNPRB | 2.00 | 18.68% |
| Svenska Handelsbanken AB | SVKE | 2.12 | 21.82% |
| UBS AG | UBQH | 2.15 | 16.64% |
| Banco Bilbao Vizcaya Argentaria SA | BBFUG | 2.18 | 22.94% |
| ABN Amro Holding NV | ABTS | 2.21 | 24.21% |
| UniCredito Italiano SpA | UNCZA | 2.25 | 15.90% |
| Rolo Banca 1473 SpA | ROGMBA | 2.37 | 16.67% |
| Dexia | DECCT | 2.76 | 14.99% |
| Average | | 1.60 | 14.96% |

# PBV versus ROE regression

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

$$PBV = 0.81 + 5.32\ (ROE)\quad R^2 = 46\%$$

- For every 1% increase in ROE, the PBV ratio should increase by 0.0532.

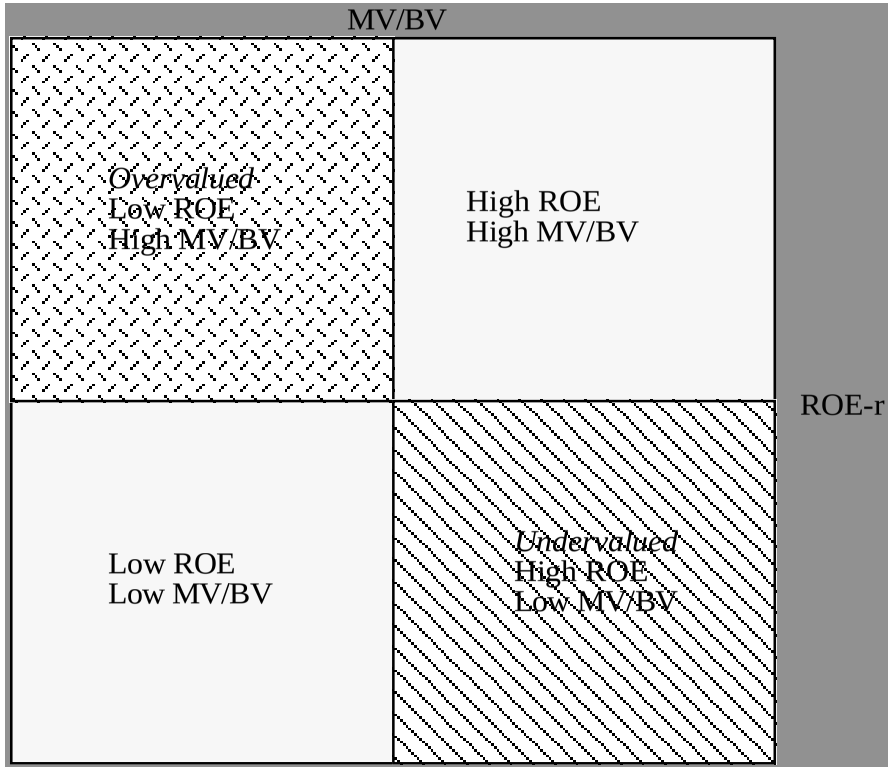
# Under and Over Valued Banks?

| *Bank* | *Actual* | *Predicted* | *Under or Over* |
|---|---|---|---|
| Banca di Roma SpA | 0.60 | 1.03 | -41.33% |
| Commerzbank AG | 0.74 | 1.10 | -32.86% |
| Bayerische Hypo und Vereinsbank AG | 0.82 | 1.09 | -24.92% |
| Intesa Bci SpA | 1.12 | 1.22 | -8.51% |
| Natexis Banques Populaires | 1.12 | 1.20 | -6.30% |
| Almanij NV Algemene Mij voor Nijver | 1.17 | 1.27 | -7.82% |
| Credit Industriel et Commercial | 1.20 | 1.31 | -8.30% |
| Credit Lyonnais SA | 1.20 | 1.17 | 2.61% |
| BNL Banca Nazionale del Lavoro SpA | 1.22 | 1.47 | -16.71% |
| Banca Monte dei Paschi di Siena SpA | 1.34 | 1.39 | -3.38% |
| Deutsche Bank AG | 1.36 | 1.73 | -21.40% |
| Skandinaviska Enskilda Banken | 1.39 | 1.68 | -17.32% |
| Nordea Bank AB | 1.40 | 1.54 | -9.02% |
| DNB Holding ASA | 1.42 | 1.70 | -16.72% |
| ForeningsSparbanken AB | 1.61 | 1.80 | -10.66% |
| Danske Bank AS | 1.66 | 1.82 | -9.01% |
| Credit Suisse Group | 1.68 | 1.57 | 7.20% |
| KBC Bankverzekeringsholding | 1.69 | 2.45 | -30.89% |
| Societe Generale | 1.73 | 1.74 | -0.42% |
| Santander Central Hispano SA | 1.83 | 1.39 | 31.37% |
| National Bank of Greece SA | 1.87 | 2.20 | -15.06% |
| San Paolo IMI SpA | 1.88 | 1.69 | 11.15% |
| BNP Paribas | 2.00 | 1.80 | 11.07% |
| Svenska Handelsbanken AB | 2.12 | 1.97 | 7.70% |
| UBS AG | 2.15 | 1.69 | 27.17% |
| Banco Bilbao Vizcaya Argentaria SA | 2.18 | 2.03 | 7.66% |
| ABN Amro Holding NV | 2.21 | 2.10 | 5.23% |
| UniCredito Italiano SpA | 2.25 | 1.65 | 36.23% |
| Rolo Banca 1473 SpA | 2.37 | 1.69 | 39.74% |
| Dexia | 2.76 | 1.61 | 72.04% |

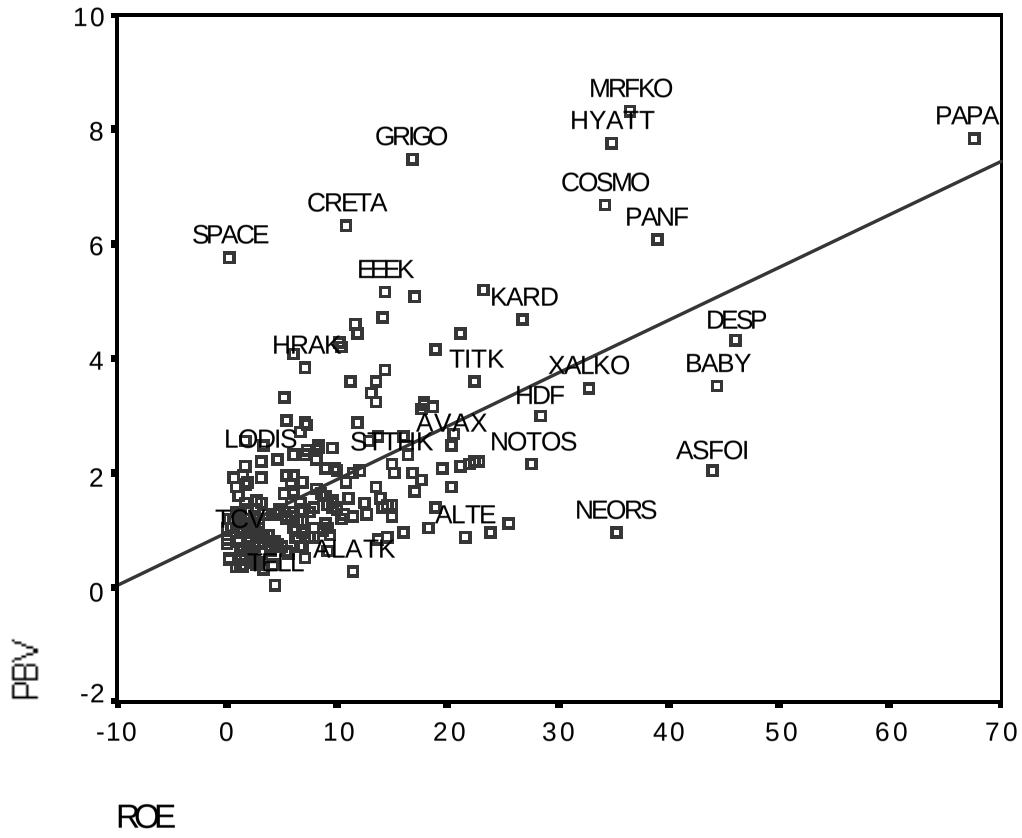
# Looking for undervalued securities - PBV Ratios and ROE

- 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

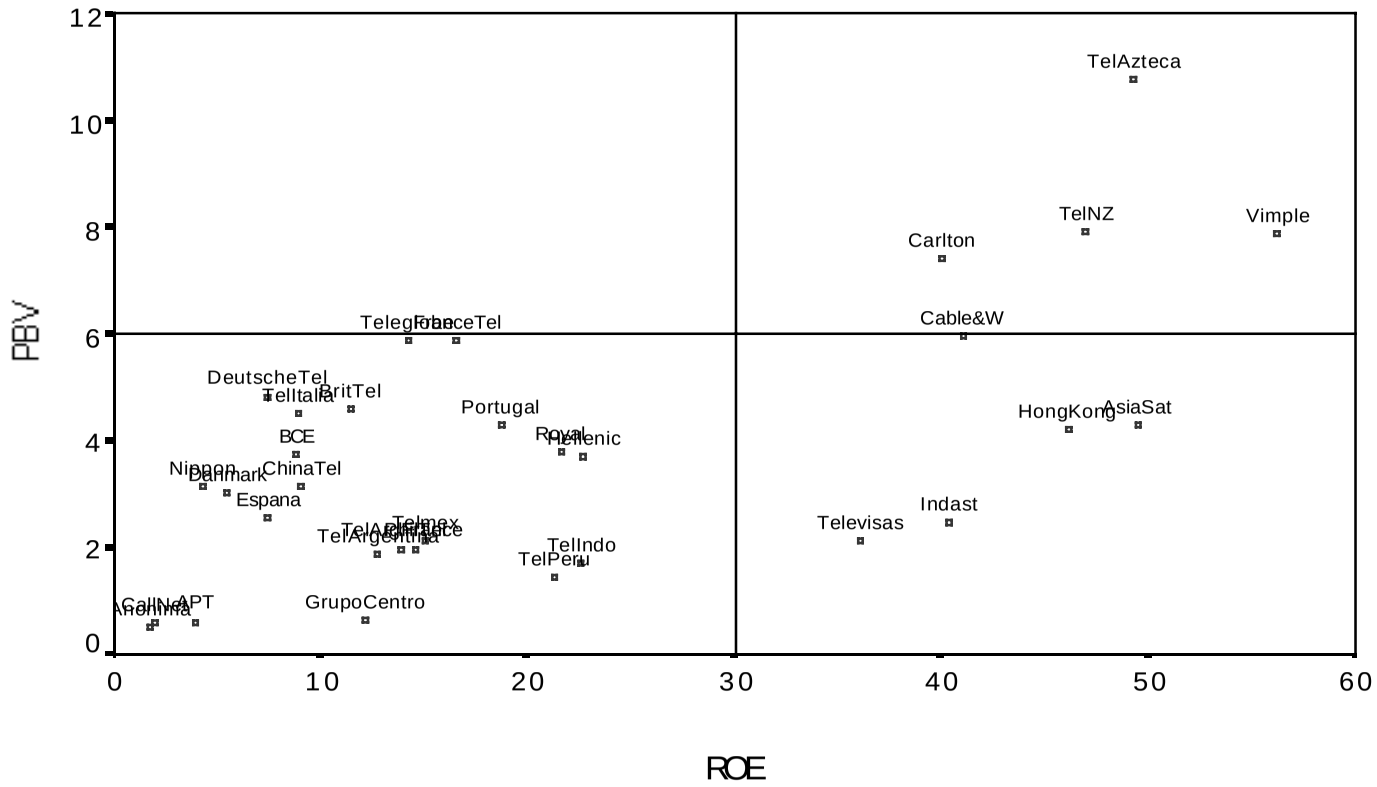


# PBV versus ROE: Greece in July 2002

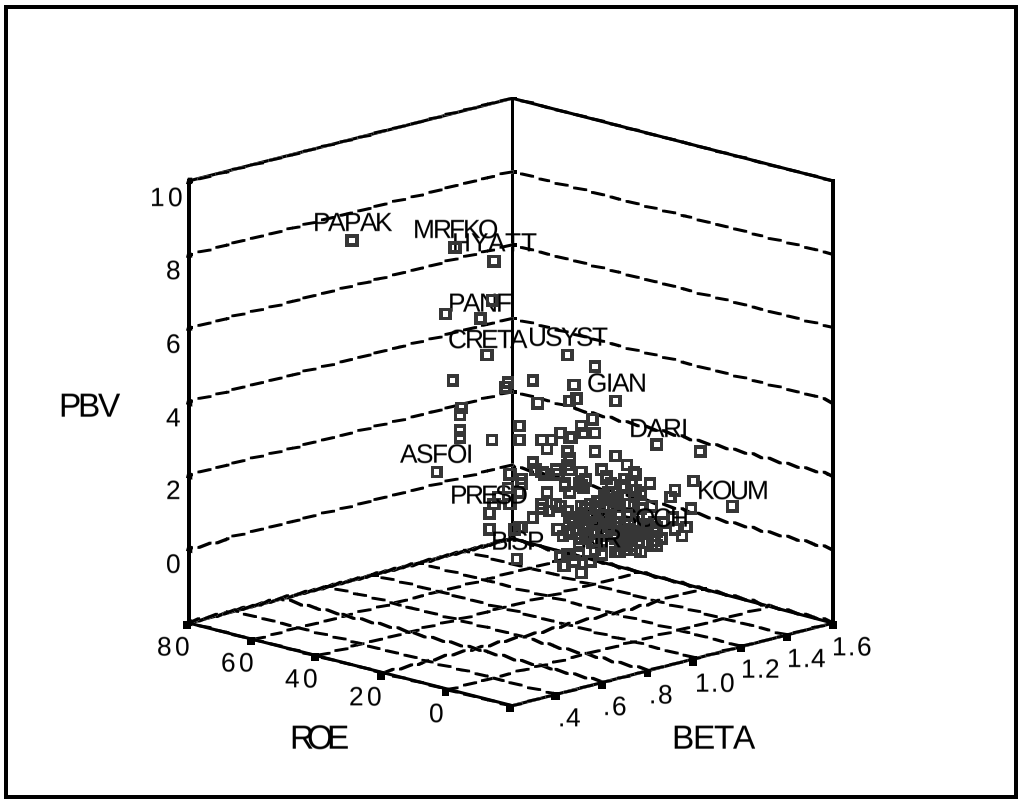



PBV = 0.96 + 9.26 ROE R sq=37%

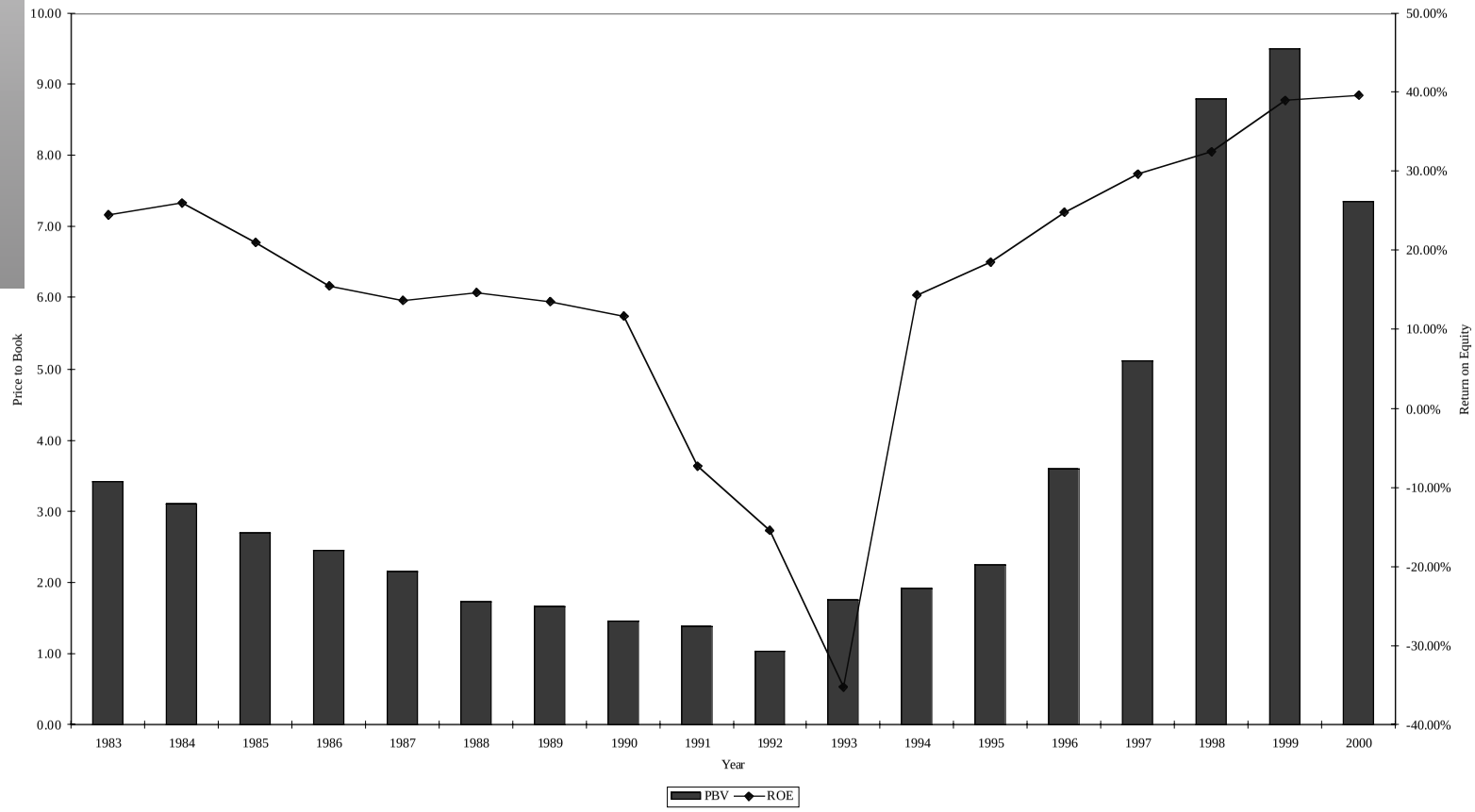
# PBV Matrix: Telecom Companies



# PBV, ROE and Risk: Greece



# IBM: The Rise and Fall and Rise Again…



# PBV Ratio Regression- Europe

**Model Summary**

| Model | R | R Square [a] | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .866[b] | .749 | .749 | 138.0941 |

a. For regression through the origin (the no-intercept model), R Square measures the proportion of the variability in the dependent variable about the origin explained by regression. This CANNOT be compared to R Square for models which include an intercept.

b. Predictors: ROE, Payout Ratio, BETA

**Coefficients[a,b,c]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | BETA | .749 | .187 | .145 | 4.001 | .000 |
| | Payout Ratio | -6.251E-03 | .003 | -.059 | -2.254 | .024 |
| | ROE | .176 | .006 | .781 | 30.388 | .000 |

a. Dependent Variable: PBV

b. Linear Regression through the Origin

c. Weighted Least Squares Regression - Weighted by Market Cap (millions)

# Cross Sectional Regression for Greece: July 2002

PBV = 3.26 + .0839 ROE - 2.30 Beta R squared = 44%

- For instance, the predicted PBV ratios for Alpha Financial would be:

*ROE = 15.85%*

*Beta = 0.90*

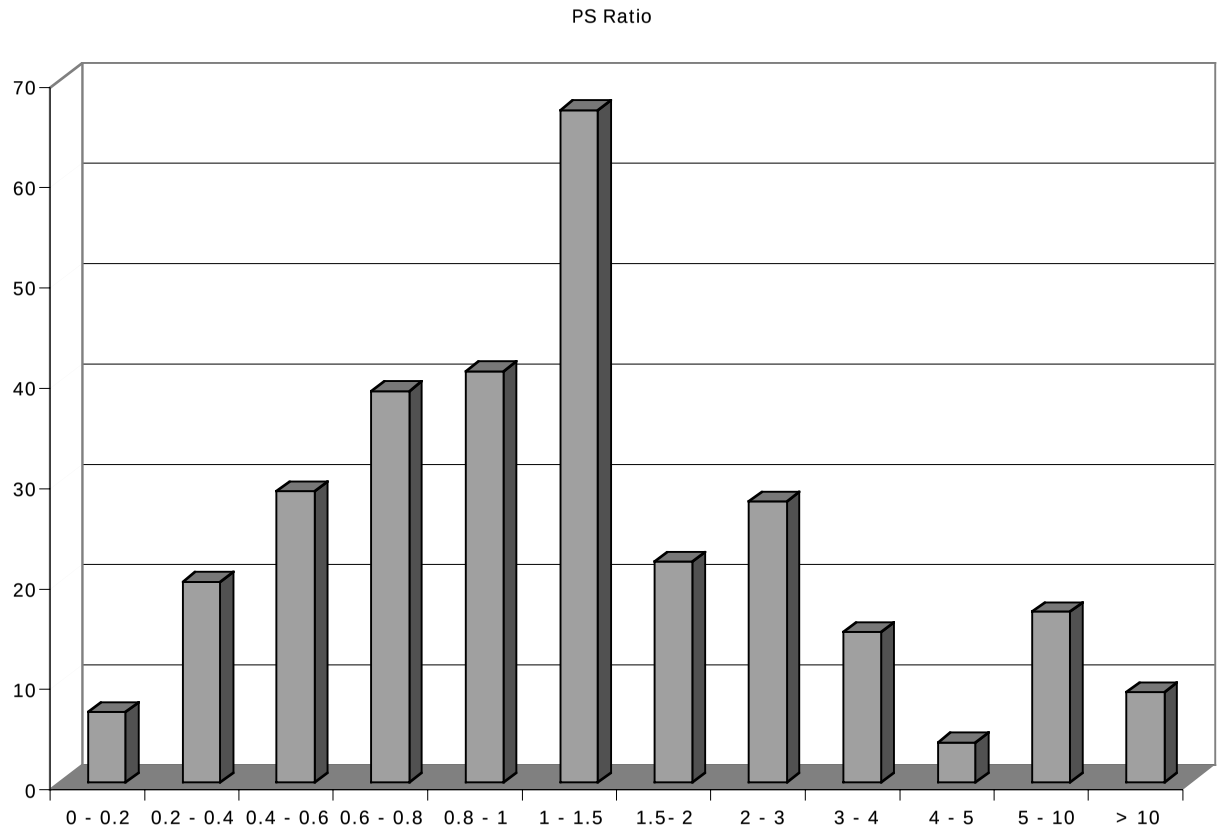
*Predicted PBV* = 3.23 + .0839 (15.85) - 2.30 (0.90) = 2.49

At an actual price to book ratio of 1.89, Alpha Financial is overvalued relative to other Greek companies.

# 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: Greece in July 2002



# Price/Sales Ratio: Determinants

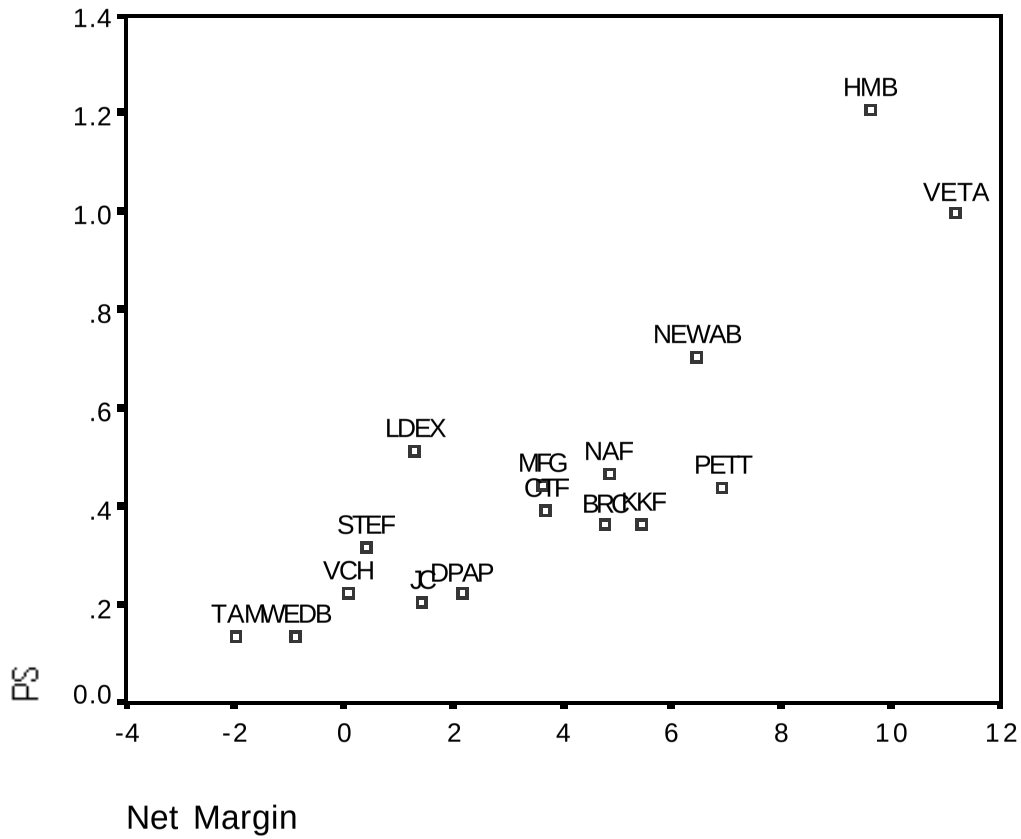
- The price/sales ratio of a stable growth firm can be estimated beginning with a 2-stage equity valuation model:

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

- 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: Retailers - Apparel and Shoes



# Regression Results: PS Ratios and Margins

- Regressing PS ratios against net margins,

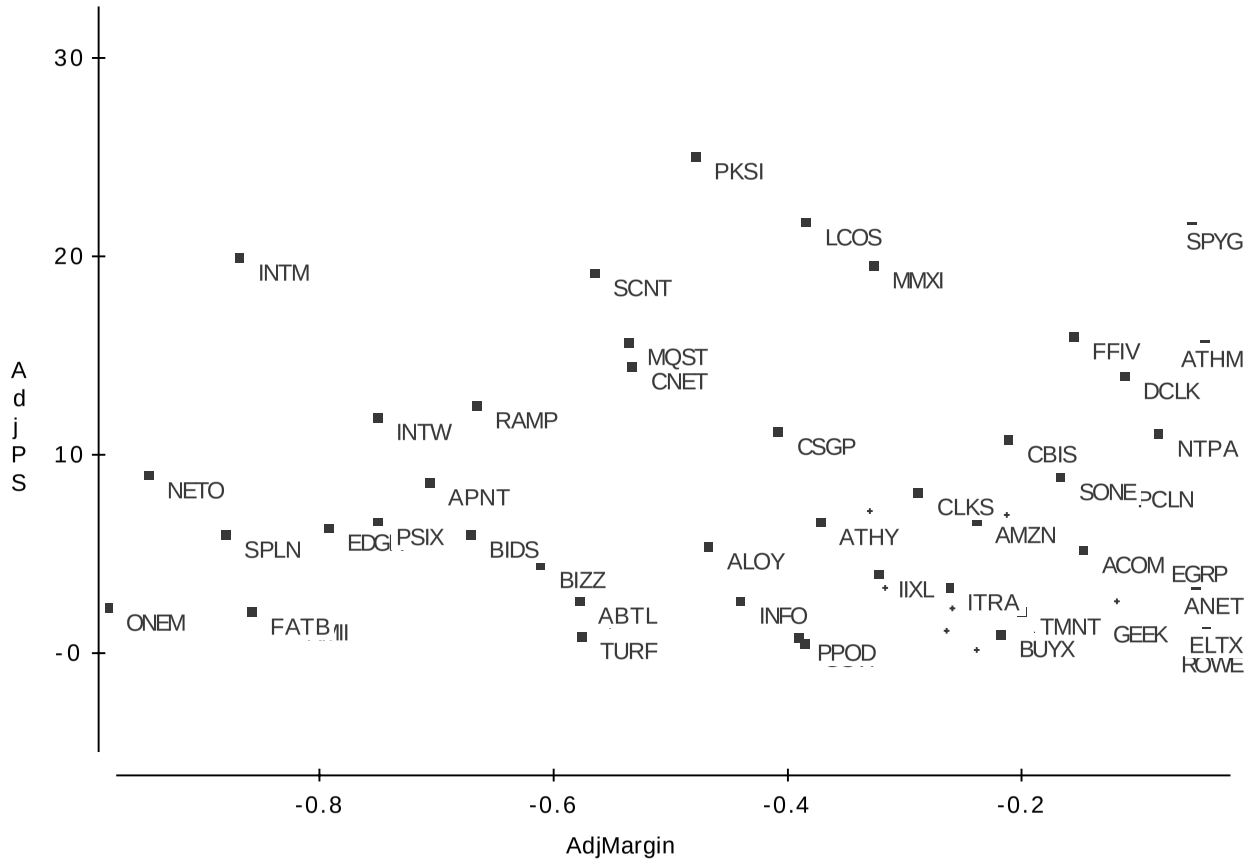
  PS = 0.28 + 9.66 (Net Margin)  $R^2$ = 95%

- Thus, a 1% increase in the margin results in an increase of 0.0966 in the price sales ratios.
- The regression also allows us to get predicted PS ratios for these firms

# 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.

# Solution 1: Use proxies for survival and growth: Amazon in early 2000

- 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.

# Solution 2: Use forward multiples

- You can always estimate price (or value) as a multiple of revenues, earnings or book value in a future year. These multiples are called forward multiples.
- For young and evolving firms, the values of fundamentals in future years may provide a much better picture of the true value potential of the firm. There are two ways in which you can use forward multiples:
  - Look at value today as a multiple of revenues or earnings in the future (say 5 years from now) for all firms in the comparable firm list. Use the average of this multiple in conjunction with your firm's earnings or revenues to estimate the value of your firm today.
  - Estimate value as a multiple of current revenues or earnings for more mature firms in the group and apply this multiple to the forward earnings or revenues to the forward earnings for your firm. This will yield the expected value for your firm in the forward year and will have to be discounted back to the present to get current value.

# An Example of Forward Multiples: Global Crossing

- Global Crossing lost $1.9 billion in 2001 and is expected to continue to lose money for the next 3 years. In a discounted cashflow valuation (see notes on DCF valuation) of Global Crossing, we estimated an expected EBITDA for Global Crossing in five years of $ 1,371 million.
- The average enterprise value/ EBITDA multiple for healthy telecomm firms is 7.2 currently.
- Applying this multiple to Global Crossing's EBITDA in year 5, yields a value in year 5 of
  - Enterprise Value in year 5 = 1371 * 7.2 = $9,871 million
  - Enterprise Value today = $ 9,871 million/ $1.138^5$ = $5,172 million

  (The cost of capital for Global Crossing is 13.80%)

# PS Regression: United States

**Model Summary**

| Model | R | R Square [a] | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .932[b] | .869 | .869 | 150.287429 |

a. For regression through the origin (the no-intercept model), R Square measures the proportion of the variability in the dependent variable about the origin explained by regression. This CANNOT be compared to R Square for models which include an intercept.

b. Predictors: Net Margin, Payout Ratio, Expected Growth in EPS: next 5 years, BETA

**Coefficients[a,b,c]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Correlations | | |
|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Zero-order | Partial | Part |
| 1 | Expected Growth in EPS: next 5 years | 9.888E-02 | .006 | .285 | 15.726 | .000 | .711 | .346 | .133 |
| | BETA | -1.142 | .104 | -.242 | -11.024 | .000 | .738 | -.250 | -.093 |
| | Payout Ratio | -1.321E-02 | .002 | -.086 | -7.860 | .000 | .470 | -.181 | -.067 |
| | Net Margin | .315 | .005 | .961 | 65.573 | .000 | .921 | .838 | .555 |

a. Dependent Variable: PS_RATIO

b. Linear Regression through the Origin

c. Weighted Least Squares Regression - Weighted by Market Cap

# PS Regression - Greece in July 2002

- PS Ratio = 2.81 +1.03 Payout - 2.25 Beta +4.53 Margin  R sq= 22%
  - There were 178 firms in the sample
  - The t statistic for the net margin variable is 4.61

# 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