



---

# PEG Ratios

Aswath Damodaran

# Investment Strategies that compare PE to the expected growth rate

---

- If we assume that all firms within a sector have similar growth rates and risk, a strategy of picking the lowest PE ratio stock in each sector will yield undervalued stocks.
- Portfolio managers and analysts sometimes compare PE ratios to the expected growth rate to identify under and overvalued stocks.
  - In the simplest form of this approach, firms with PE ratios less than their expected growth rate are viewed as undervalued.
  - In its more general form, the ratio of PE ratio to growth is used as a measure of relative value.

# Problems with comparing PE ratios to expected growth

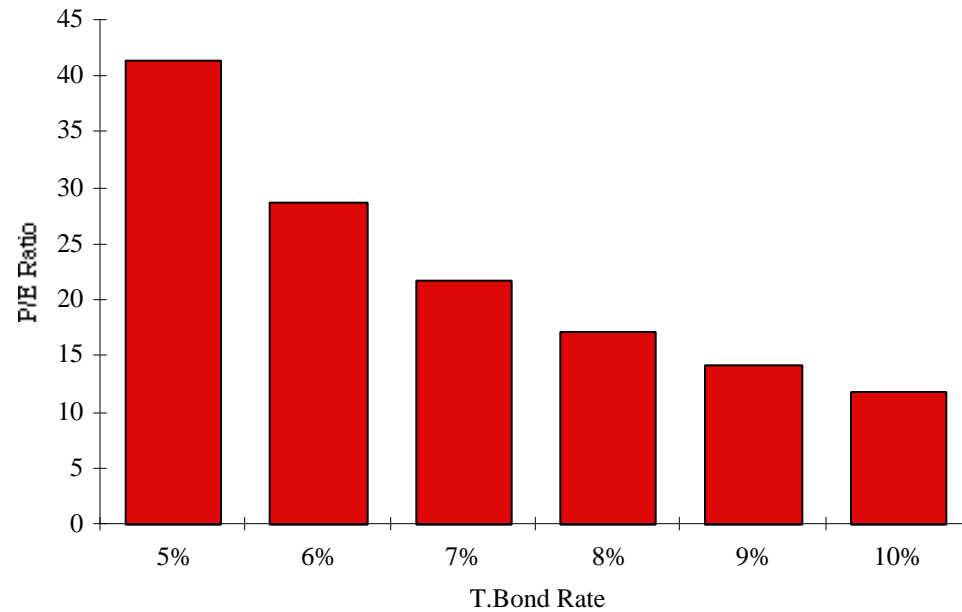
---

- In its simple form, there is no basis for believing that a firm is undervalued just because it has a PE ratio less than expected growth.
- This relationship may be consistent with a fairly valued or even an overvalued firm, if interest rates are high, or if a firm is high risk.
- As interest rate decrease (increase), fewer (more) stocks will emerge as undervalued using this approach.

# PE Ratio versus Growth - The Effect of Interest rates:

Average Risk firm with 25% growth for 5 years; 8% thereafter

Figure 14.2: PE Ratios and T.Bond Rates



# PE Ratios Less Than The Expected Growth Rate

---

- In September 2001,
  - 33% of firms had PE ratios lower than the expected 5-year growth rate
  - 67% of firms had PE ratios higher than the expected 5-year growth rate
- In comparison,
  - 38.1% of firms had PE ratios less than the expected 5-year growth rate in September 1991
  - 65.3% of firm had PE ratios less than the expected 5-year growth rate in 1981.

# PEG Ratio: Definition

---

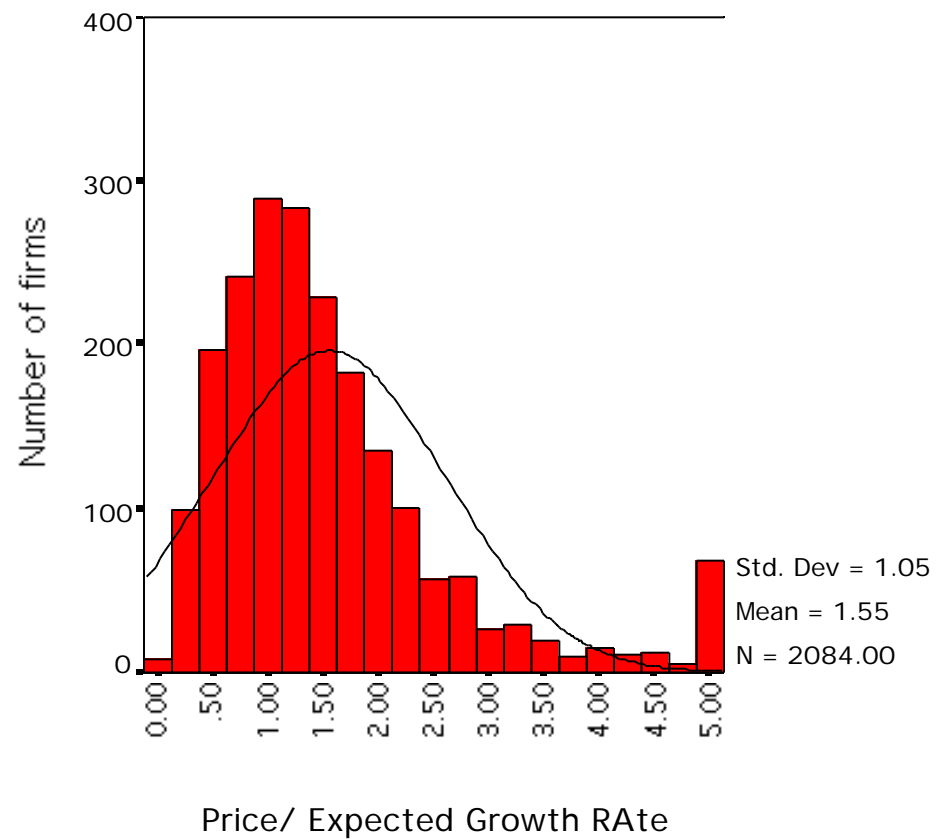
- The PEG ratio is the ratio of price earnings to expected growth in earnings per share.

$$\text{PEG} = \text{PE} / \text{Expected Growth Rate in Earnings}$$

- Definitional tests:

- Is the growth rate used to compute the PEG ratio
  - on the same base? (base year EPS)
  - over the same period?(2 years, 5 years)
  - from the same source? (analyst projections, consensus estimates..)
- Is the earnings used to compute the PE ratio consistent with the growth rate estimate?
  - No double counting: If the estimate of growth in earnings per share is from the current year, it would be a mistake to use forward EPS in computing PE
  - If looking at foreign stocks or ADRs, is the earnings used for the PE ratio consistent with the growth rate estimate? (US analysts use the ADR EPS)

# PEG Ratio: Distribution



# PEG Ratios: The Beverage Sector

<i>Company Name</i>	<i>Trailing PE</i>	<i>Growth</i>	<i>Std Dev</i>	<i>PEG</i>
Coca-Cola Bottling	29.18	9.50%	20.58%	3.07
Molson Inc. Ltd. 'A'	43.65	15.50%	21.88%	2.82
Anheuser-Busch	24.31	11.00%	22.92%	2.21
Corby Distilleries Ltd.	16.24	7.50%	23.66%	2.16
Chalone Wine Group Ltd.	21.76	14.00%	24.08%	1.55
Andres Wines Ltd. 'A'	8.96	3.50%	24.70%	2.56
Todhunter Int'l	8.94	3.00%	25.74%	2.98
Brown-Forman 'B'	10.07	11.50%	29.43%	0.88
Coors (Adolph) 'B'	23.02	10.00%	29.52%	2.30
PepsiCo, Inc.	33.00	10.50%	31.35%	3.14
Coca-Cola	44.33	19.00%	35.51%	2.33
Boston Beer 'A'	10.59	17.13%	39.58%	0.62
Whitman Corp.	25.19	11.50%	44.26%	2.19
Mondavi (Robert) 'A'	16.47	14.00%	45.84%	1.18
Coca-Cola Enterprises	37.14	27.00%	51.34%	1.38
Hansen Natural Corp	9.70	17.00%	62.45%	0.57
<b>Average</b>	<b>22.66</b>	<b>0.13</b>	<b>0.33</b>	<b>2.00</b>

# PEG Ratio: Reading the Numbers

---

- The average PEG ratio for the beverage sector is 2.00. The lowest PEG ratio in the group belongs to Hansen Natural, which has a PEG ratio of 0.57. Using this measure of value, Hansen Natural is
  - the most under valued stock in the group
  - the most over valued stock in the group
- What other explanation could there be for Hansen's low PEG ratio?

# PEG Ratio: Analysis

- To understand the fundamentals that determine PEG ratios, let us return again to a 2-stage equity discounted cash flow model

$$P_0 = \frac{\text{EPS}_0 * \text{Payout Ratio} * \left(1 - \frac{(1+g)^n}{(1+r)^n}\right)}{r-g} + \frac{\text{EPS}_0 * \text{Payout Ratio}_n * (1+g)^n * (1+g_n)}{(r-g_n)(1+r)^n}$$

- Dividing both sides of the equation by the earnings gives us the equation for the PE ratio. Dividing it again by the expected growth 'g'

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

# PEG Ratios and Fundamentals

---

- Risk and payout, which affect PE ratios, continue to affect PEG ratios as well.
  - Implication: When comparing PEG ratios across companies, we are making implicit or explicit assumptions about these variables.
- Dividing PE by expected growth does not neutralize the effects of expected growth, since the relationship between growth and value is not linear and fairly complex (even in a 2-stage model)

## A Simple Example

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

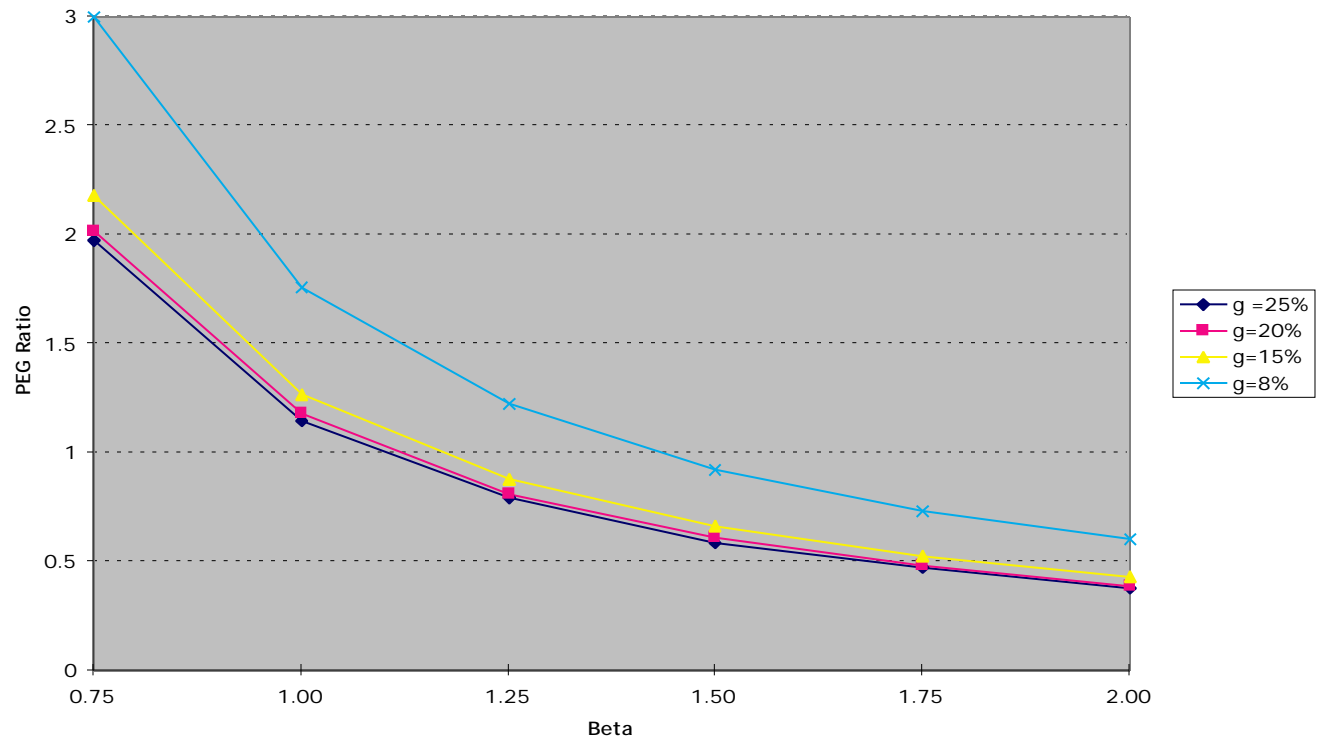
Variable	High Growth Phase	Stable Growth Phase
Expected Growth Rate	25%	8%
Payout Ratio	20%	50%
Beta	1.00	1.00

- Riskfree rate = T.Bond Rate = 6%
- Required rate of return = 6% + 1(5.5%)= 11.5%
- The PEG ratio for this firm can be estimated as follows:

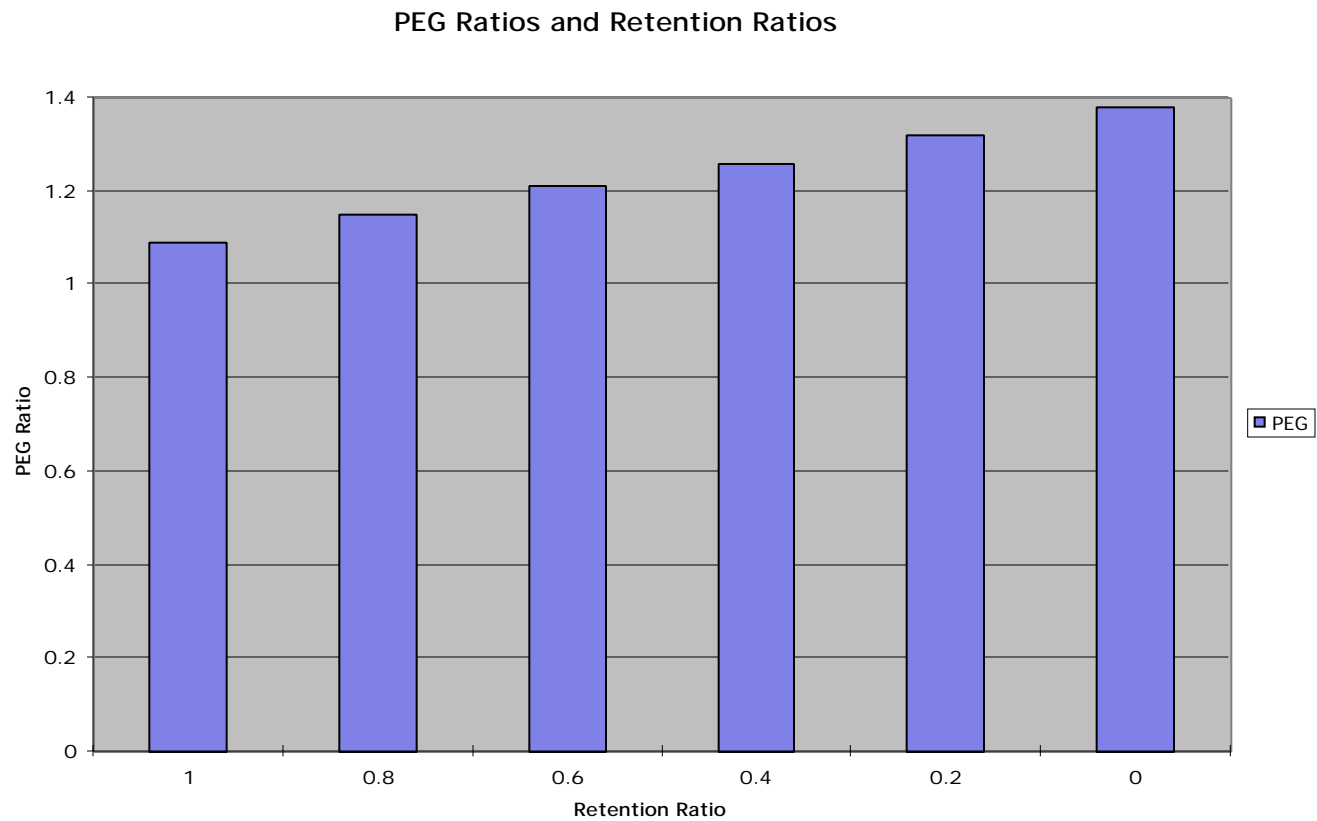
$$\text{PEG} = \frac{0.2 * (1.25) * \left(1 - \frac{(1.25)^5}{(1.115)^5}\right)}{.25(.115 - .25)} + \frac{0.5 * (1.25)^5 * (1.08)}{.25(.115-.08) (1.115^5)} = .115 \text{ or } 1.15$$

# PEG Ratios and Risk

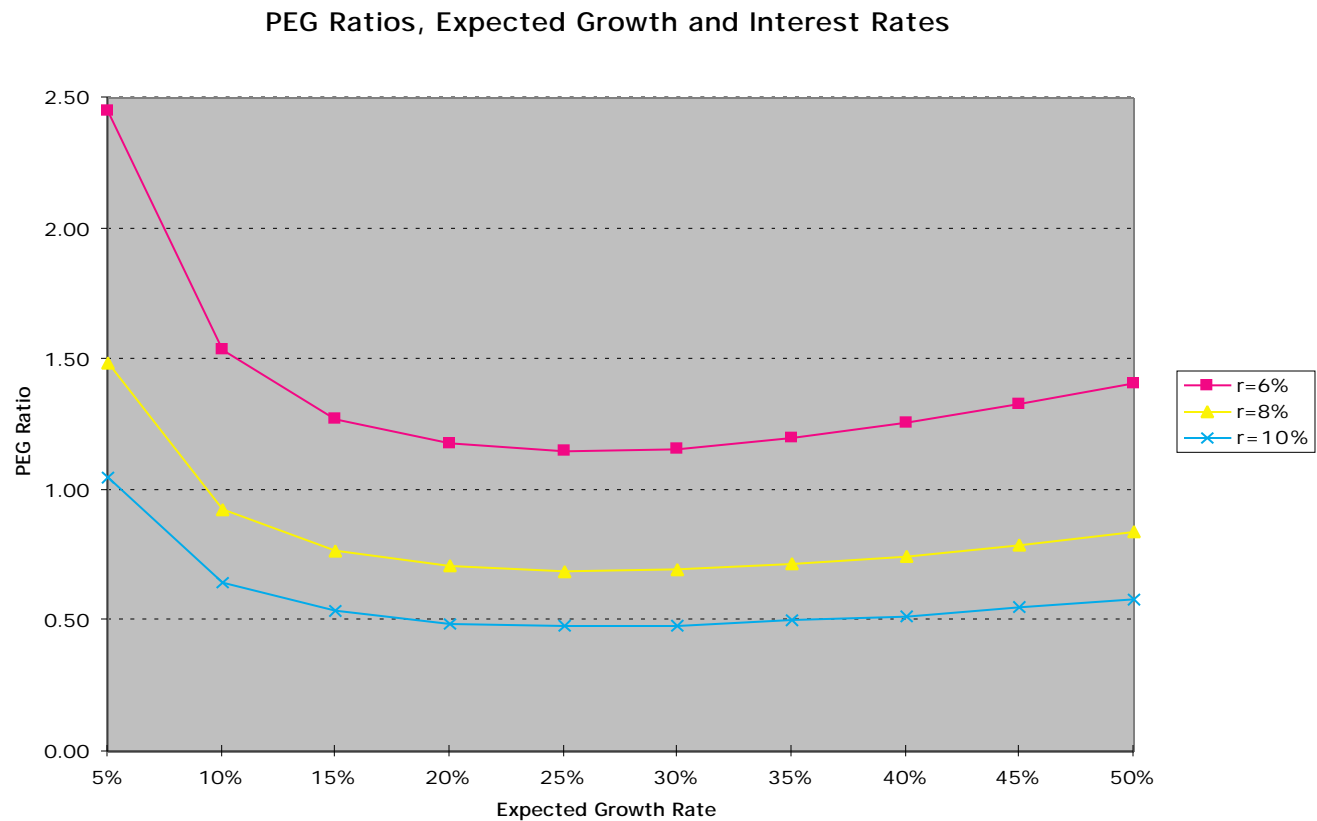
PEG Ratios and Beta: Different Growth Rates



# PEG Ratios and Quality of Growth



# PE Ratios and Expected Growth

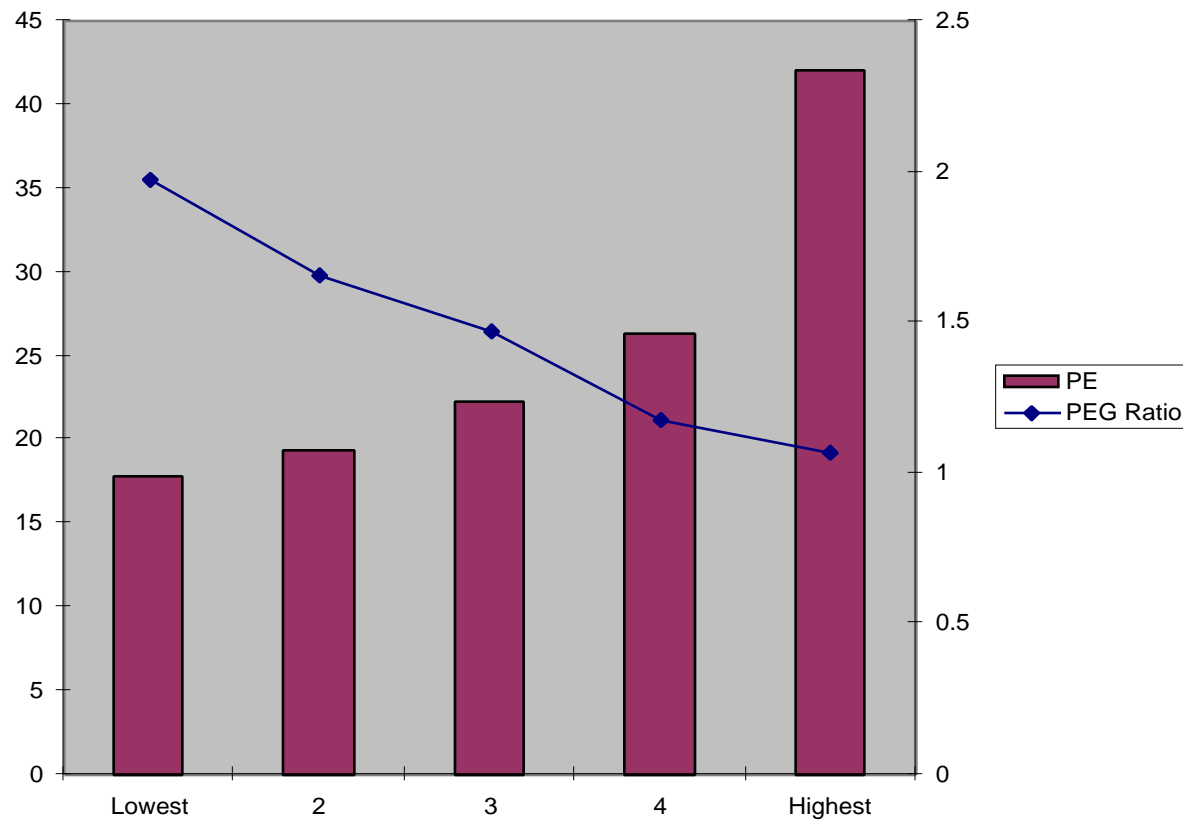


# PEG Ratios and Fundamentals: Propositions

---

- Proposition 1: High risk companies will trade at much lower PEG ratios than low risk companies with the same expected growth rate.
  - Corollary 1: The company that looks most under valued on a PEG ratio basis in a sector may be the riskiest firm in the sector
- Proposition 2: Companies that can attain growth more efficiently by investing less in better return projects will have higher PEG ratios than companies that grow at the same rate less efficiently.
  - Corollary 2: Companies that look cheap on a PEG ratio basis may be companies with high reinvestment rates and poor project returns.
- Proposition 3: Companies with very low or very high growth rates will tend to have higher PEG ratios than firms with average growth rates. This bias is worse for low growth stocks.
  - Corollary 3: PEG ratios do not neutralize the growth effect.

# PE, PEG Ratios and Risk



## PEG Ratio: Returning to the Beverage Sector

<i>Company Name</i>	<i>Trailing PE</i>	<i>Growth</i>	<i>Std Dev</i>	<i>PEG</i>
Coca-Cola Bottling	29.18	9.50%	20.58%	3.07
Molson Inc. Ltd. 'A'	43.65	15.50%	21.88%	2.82
Anheuser-Busch	24.31	11.00%	22.92%	2.21
Corby Distilleries Ltd.	16.24	7.50%	23.66%	2.16
Chalone Wine Group Ltd.	21.76	14.00%	24.08%	1.55
Andres Wines Ltd. 'A'	8.96	3.50%	24.70%	2.56
Todhunter Int'l	8.94	3.00%	25.74%	2.98
Brown-Forman 'B'	10.07	11.50%	29.43%	0.88
Coors (Adolph) 'B'	23.02	10.00%	29.52%	2.30
PepsiCo, Inc.	33.00	10.50%	31.35%	3.14
Coca-Cola	44.33	19.00%	35.51%	2.33
Boston Beer 'A'	10.59	17.13%	39.58%	0.62
Whitman Corp.	25.19	11.50%	44.26%	2.19
Mondavi (Robert) 'A'	16.47	14.00%	45.84%	1.18
Coca-Cola Enterprises	37.14	27.00%	51.34%	1.38
Hansen Natural Corp	9.70	17.00%	62.45%	0.57
<b>Average</b>	<b>22.66</b>	<b>0.13</b>	<b>0.33</b>	<b>2.00</b>

# Analyzing PE/Growth

---

- Given that the PEG ratio is still determined by the expected growth rates, risk and cash flow patterns, it is necessary that we control for differences in these variables.
- Regressing PEG against risk and a measure of the growth dispersion, we get:

$$\text{PEG} = 3.61 - 2.86 (\text{Expected Growth}) - 3.75 (\text{Std Deviation in Prices})$$

$$\text{R Squared} = 44.75\%$$

- In other words,
  - PEG ratios will be lower for high growth companies
  - PEG ratios will be lower for high risk companies
- We also ran the regression using the deviation of the actual growth rate from the industry-average growth rate as the independent variable, with mixed results.

# Estimating the PEG Ratio for Hansen

---

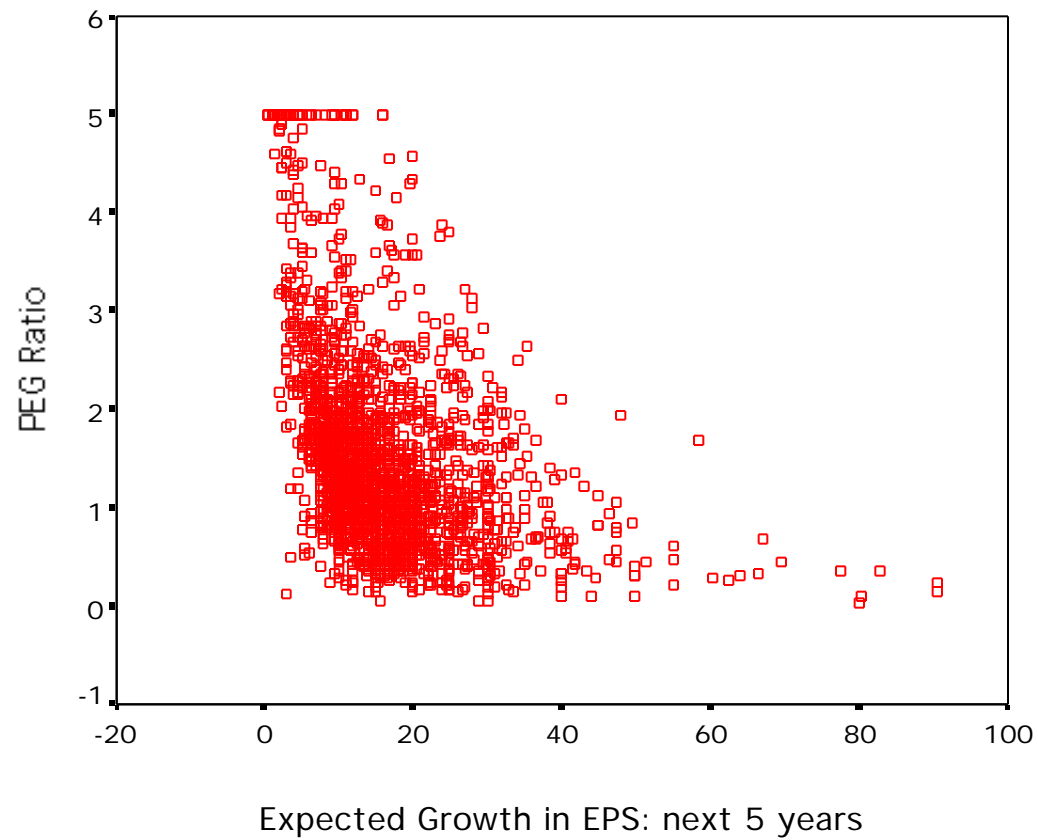
- Applying this regression to Hansen, the predicted PEG ratio for the firm can be estimated using Hansen's measures for the independent variables:
  - Expected Growth Rate = 17.00%
  - Standard Deviation in Stock Prices = 62.45%
- Plugging in,  
Expected PEG Ratio for Hansen =  $3.61 - 2.86 (.17) - 3.75 (.6245)$   
 $= 0.78$
- With its actual PEG ratio of 0.57, Hansen looks undervalued, notwithstanding its high risk.

# Extending the Comparables

---

- This analysis, which is restricted to firms in the software sector, can be expanded to include all firms in the firm, as long as we control for differences in risk, growth and payout.
- To look at the cross sectional relationship, we first plotted PEG ratios against expected growth rates.

# PEG versus Growth

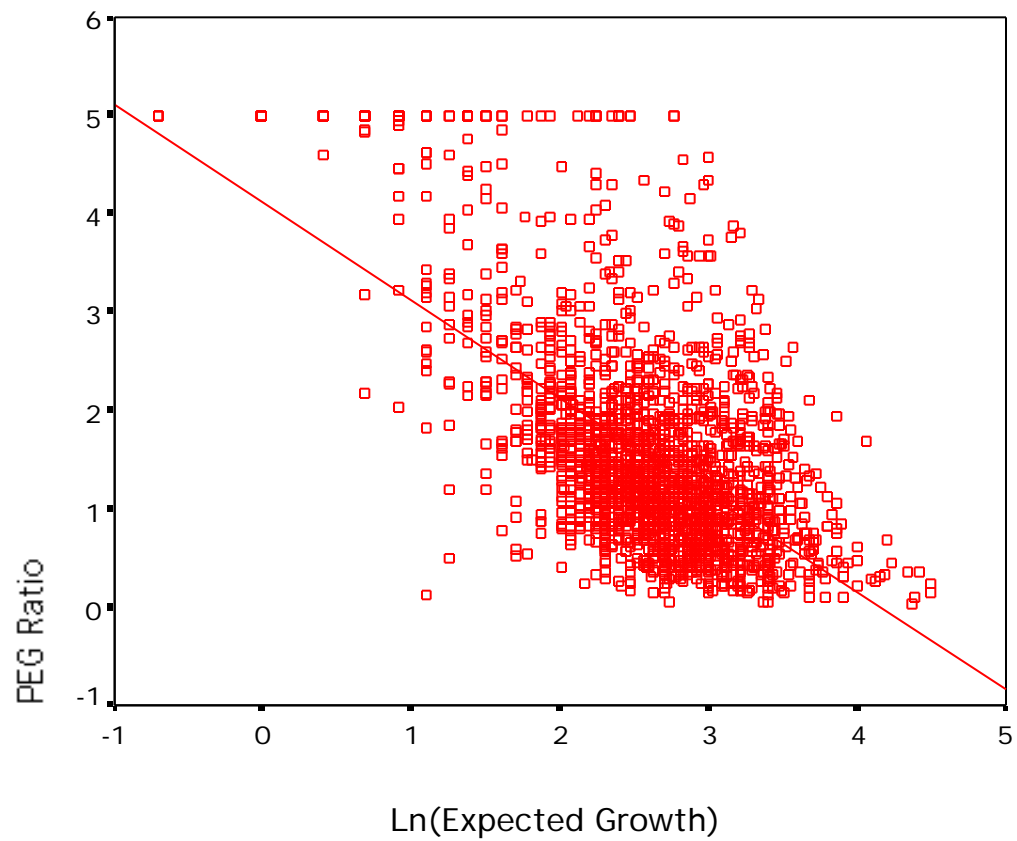


## Analyzing the Relationship

---

- The relationship is not linear. In fact, the smallest firms seem to have the highest PEG ratios and PEG ratios become relatively stable at higher growth rates.
- To make the relationship more linear, we converted the expected growth rates to  $\ln(\text{expected growth rate})$ . The relationship between PEG ratios and  $\ln(\text{expected growth rate})$  was then plotted.

# PEG versus $\ln(\text{Expected Growth})$



# Market PEG Ratio Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.587 <sup>a</sup>	.344	.343	56.7746

a. Predictors: (Constant), LNGROWTH, PAYOUT1, Beta

Coefficients<sup>a,b</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.935	.112		35.175	.000
	Beta	-7.249E-02	.064	-.025	-1.140	.255
	PAYOUT1	.575	.084	.149	6.873	.000
	LNGROWTH	-.867	.037	-.509	-23.522	.000

a. Dependent Variable: PEG1

b. Weighted Least Squares Regression - Weighted by Market Cap

## Applying the PEG ratio regression

---

- Consider Dell again. The stock has an expected growth rate of 10%, a beta of 1.40 and pays out no dividends. What should its PEG ratio be?
  
- If the stock's actual PE ratio is 18, what does this analysis tell you about the stock?

## A Variant on PEG Ratio: The PEGY ratio

---

- The PEG ratio is biased against low growth firms because the relationship between value and growth is non-linear. One variant that has been devised to consolidate the growth rate and the expected dividend yield:

$$\text{PEGY} = \text{PE} / (\text{Expected Growth Rate} + \text{Dividend Yield})$$

- As an example, Con Ed has a PE ratio of 16, an expected growth rate of 5% in earnings and a dividend yield of 4.5%.
  - $\text{PEG} = 16 / 5 = 3.2$
  - $\text{PEGY} = 16 / (5 + 4.5) = 1.7$