Example 1: 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:	EPS in most recent financial year
	EPS in trailing 12 months
	Forecasted earnings per share next year
	Forecasted earnings per share in future year

Example 2: Staying on PE ratios

- Assuming that you are comparing the PE ratios across technology companies, many of which have options outstanding. What measure of PE ratio would yield the most consistent comparisons?
  a. Price/ Primary EPS (actual shares, no options)
  b. Price/ Fully Diluted EPS (actual shares + all options)
  c. Price/ Partially Diluted EPS (counting only in-the-money options)
  d. Other

Example 3: Enterprise Value /EBITDA Multiple

- The enterprise value to EBITDA multiple is obtained by netting cash out against debt to arrive at enterprise value and dividing by EBITDA.

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

1. Why do we net out cash from firm value?
2. What happens if a firm has cross holdings which are categorized as:
   - Minority interests?
   - Majority active interests?

Example 4: A Housing Price Multiple

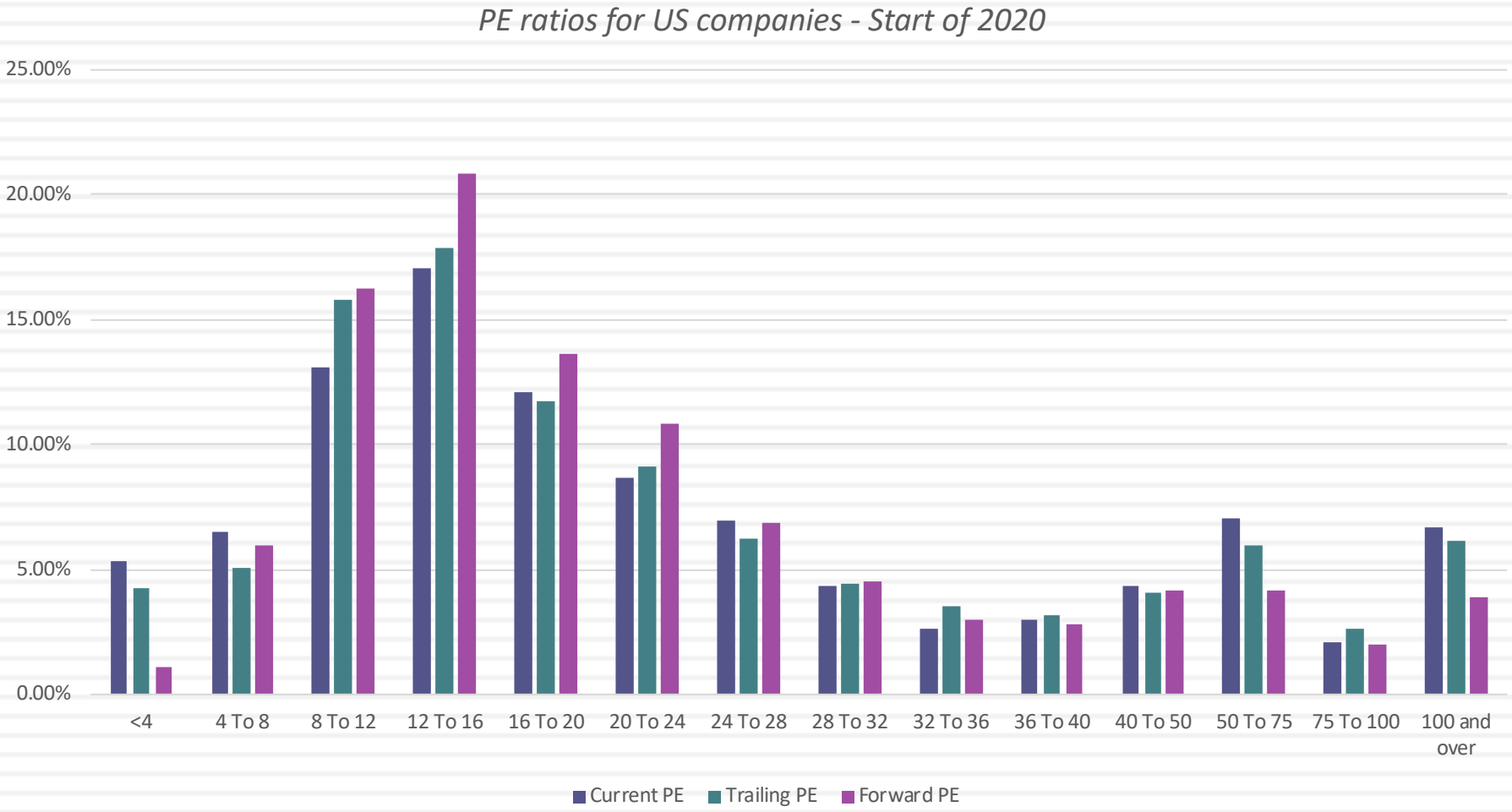
The bubbles and busts in housing prices has led investors to search for a multiple that they can use to determine when housing prices are getting out of line. One measure that has acquired adherents is the ratio of housing price to annual net rental income (for renting out the same house). Assume that you decide to compute this ratio and compare it to the multiple at which stocks are trading. Which valuation ratio would be the one that corresponds to the house price/rent ratio?

a. Price Earnings Ratio
b. EV to Sales
c. EV to EBITDA
d. EV to EBIT

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?

1. Multiples have skewed distributions… US company PE Ratios



2. Making statistics "dicey"

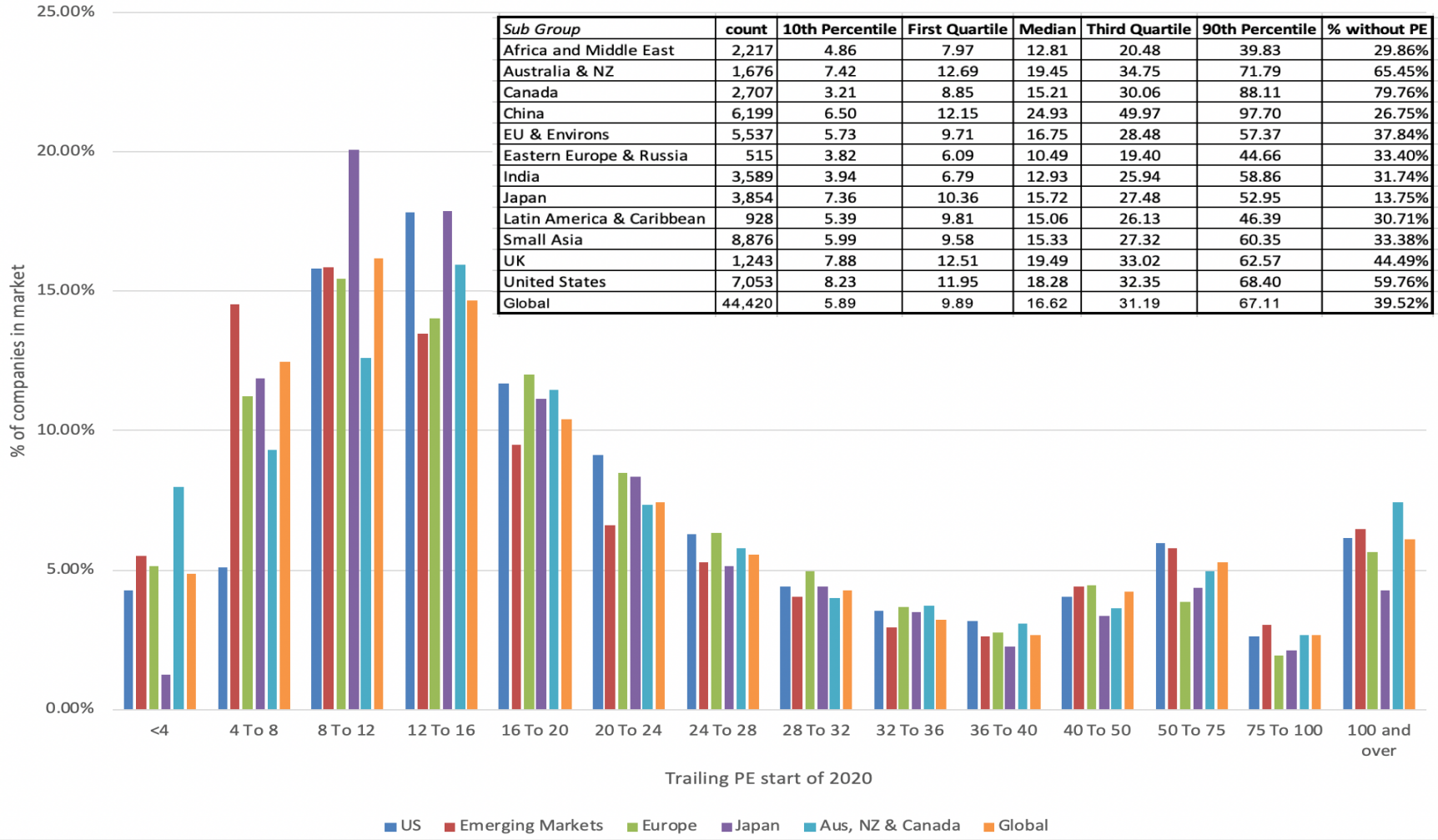
	Current PE	Trailing PE	Forward PE
Total Number of firms	7082	7082	7082
Firms with PE	2948	2838	2387
Average	**60.52**	**70.85**	**35.79**
Median	**18.49**	**18.28**	**17.56**
10the Percentile	7.09	8.23	9.27
First Quartile	11.98	11.95	12.22
Third Quartile	33.08	32.35	27.74
90th Percentile	67.99	68.4	50
Maximum	9180.91	41200	8643.33

US firms in January 2020

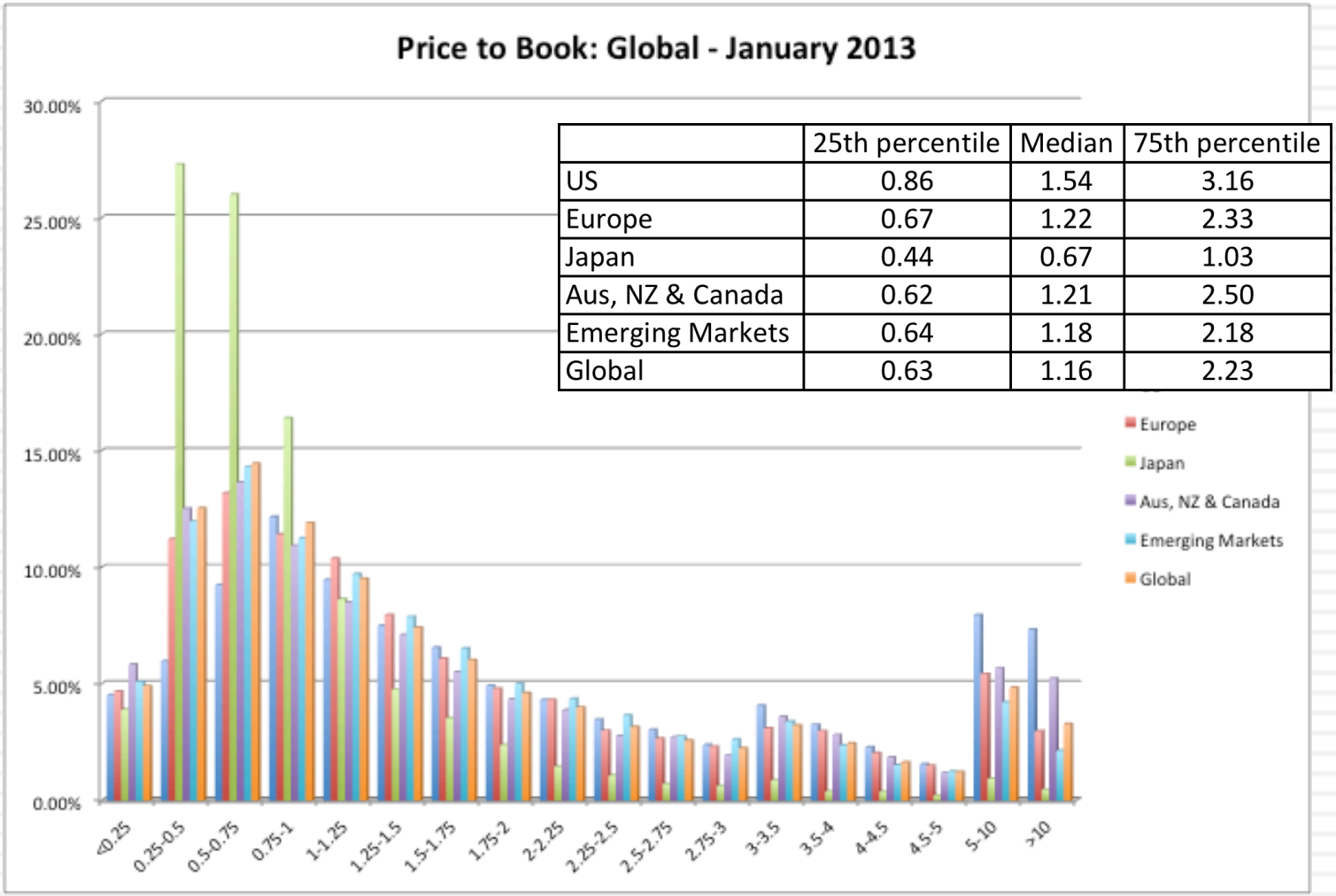
3. Markets have a lot in common : Comparing Global PEs

PE Ratios across the globe: January 2020

Sub Group	count	10th Percentile	First Quartile	Median	Third Quartile	90th Percentile	% without PE
Africa and Middle East	2,217	4.86	7.97	12.81	20.48	39.83	29.86%
Australia & NZ	1,676	7.42	12.69	19.45	34.75	71.79	65.45%
Canada	2,707	3.21	8.85	15.21	30.06	88.11	79.76%
China	6,199	6.50	12.15	24.93	49.97	97.70	26.75%
EU & Environs	5,537	5.73	9.71	16.75	28.48	57.37	37.84%
Eastern Europe & Russia	515	3.82	6.09	10.49	19.40	44.66	33.40%
India	3,589	3.94	6.79	12.93	25.94	58.86	31.74%
Japan	3,854	7.36	10.36	15.72	27.48	52.95	13.75%
Latin America & Caribbean	928	5.39	9.81	15.06	26.13	46.39	30.71%
Small Asia	8,876	5.99	9.58	15.33	27.32	60.35	33.38%
UK	1,243	7.88	12.51	19.49	33.02	62.57	44.49%
United States	7,053	8.23	11.95	18.28	32.35	68.40	59.76%
Global	44,420	5.89	9.89	16.62	31.19	67.11	39.52%

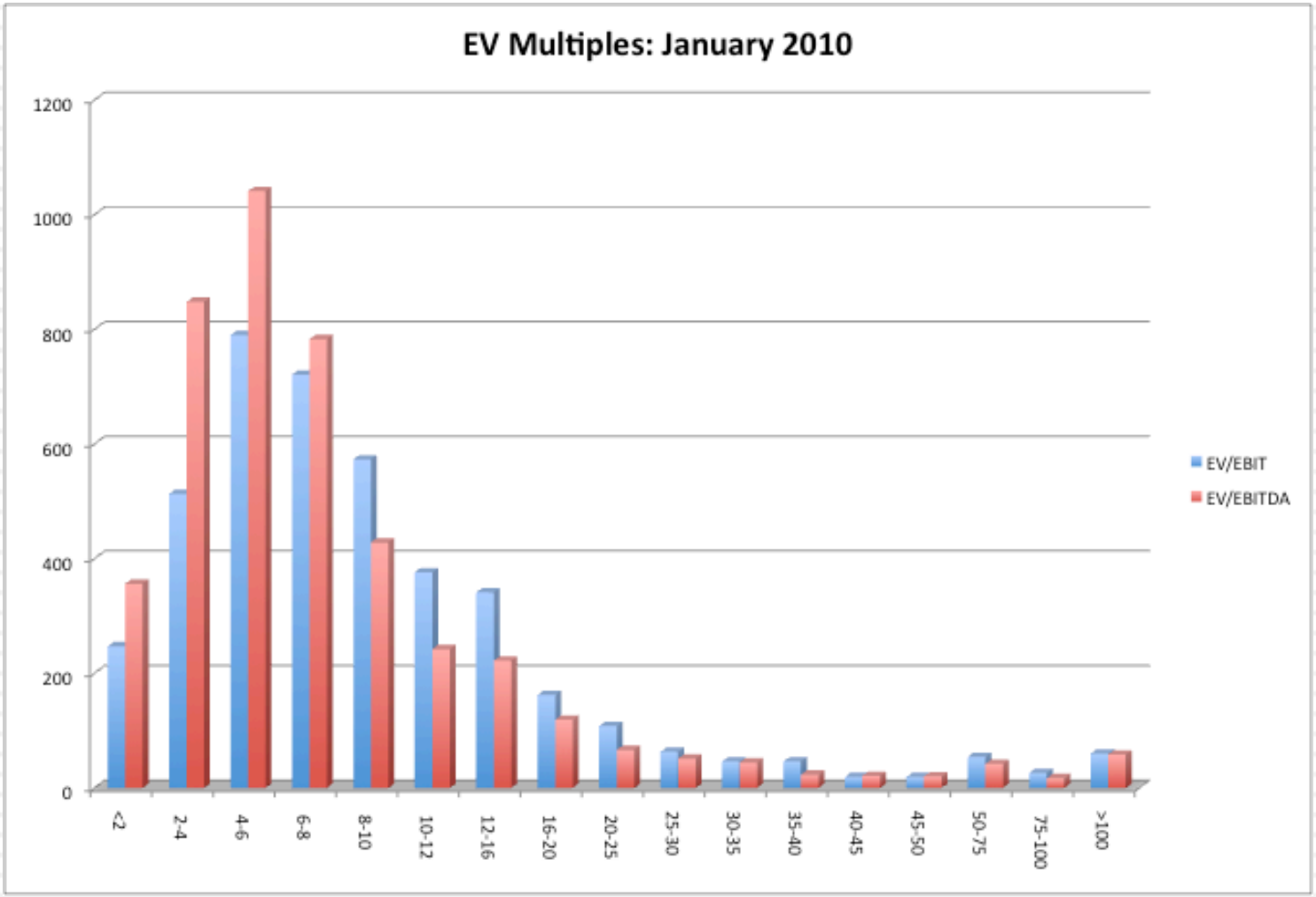


3a. And the differences are sometimes revealing… Price to Book Ratios across globe – January 2013



	25th percentile	Median	75th percentile
US	0.86	1.54	3.16
Europe	0.67	1.22	2.33
Japan	0.44	0.67	1.03
Aus, NZ & Canada	0.62	1.21	2.50
Emerging Markets	0.64	1.18	2.18
Global	0.63	1.16	2.23

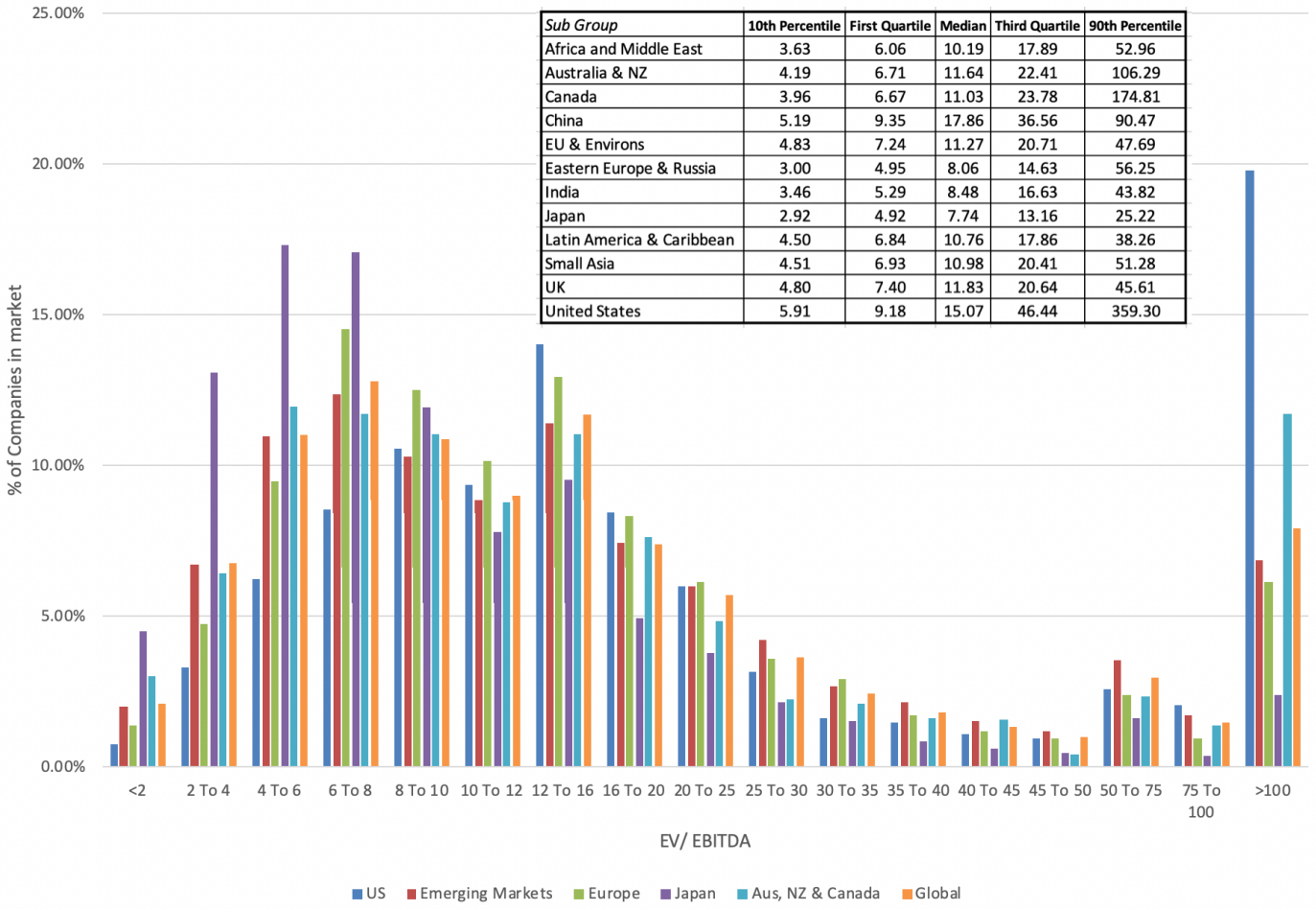
4. Simplistic rules almost always break down…6 times EBITDA was not cheap in 2010…



But it may be in 2020, unless you in Japan or Russia…

EV to EBITDA Multiples for Global Companies in January 2020

Sub Group	10th Percentile	First Quartile	Median	Third Quartile	90th Percentile
Africa and Middle East	3.63	6.06	10.19	17.89	52.96
Australia & NZ	4.19	6.71	11.64	22.41	106.29
Canada	3.96	6.67	11.03	23.78	174.81
China	5.19	9.35	17.86	36.56	90.47
EU & Environs	4.83	7.24	11.27	20.71	47.69
Eastern Europe & Russia	3.00	4.95	8.06	14.63	56.25
India	3.46	5.29	8.48	16.63	43.82
Japan	2.92	4.92	7.74	13.16	25.22
Latin America & Caribbean	4.50	6.84	10.76	17.86	38.26
Small Asia	4.51	6.93	10.98	20.41	51.28
UK	4.80	7.40	11.83	20.64	45.61
United States	5.91	9.18	15.07	46.44	359.30



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.
- How do changes in these fundamentals change the multiple?
  - The relationship between a fundamental (like growth) and a multiple (such as PE) is almost never linear.
  - Proposition 3: It is impossible to properly compare firms on a multiple, if we do not know how fundamentals and the multiple move.

A Simple Analytical device

	Start with a basic intrinsic value model	*Divide both sides of the equation by the denominator of the multiple that you are trying to deconstruct,.*	You should end up with an intrinsic version of your multiple, which should relate it to fundamentals.
If Equity Multiple	Start with a dividend or FCFE model, preferably simple. Price= EPS * Payout / (r -g)	Divide your dividend or FCFE model by denominator of equity multiple. Prtce/Book = ROE * Payout / (r -g)	Intrinsic version of equity multiple, with drivers of value Price/Book = f(ROE, r, g, Payout)
If EV Multiple	Start with a operating asset value model, preferably simple. EV= EBIT (1-t) (1- RIR)/ (WACC -g)	Divide your operating asset model by denominator of EV multiple. EV/Sales = After-tax Operating Margin (1- RIR)/ (WACC -g)	Intrinsic version of EV multiple, with drivers of value EV/Sales = f(After-tax Operating Margin, RIR, WACC, g)

I . PE Ratios

- 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 current 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,

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

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

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:

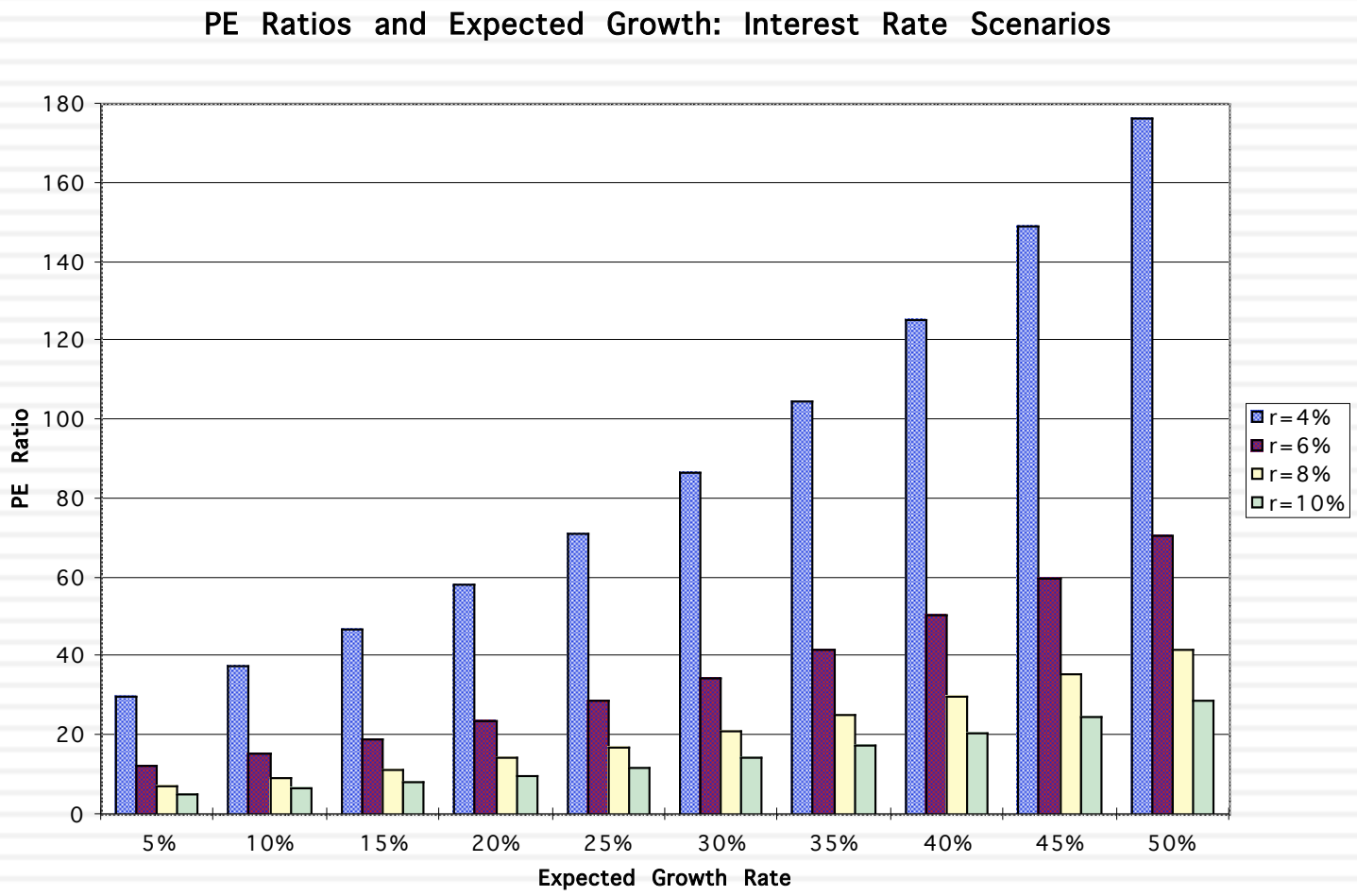
Variable	*High Growth Phase*	*Stable Growth Phase*
Expected Growth Rate	25%	8%
Payout Ratio	20%	50%
Beta	1.00	1.00
Number of years	5 years	Forever after year 5

Riskfree rate = T.Bond Rate = 6%

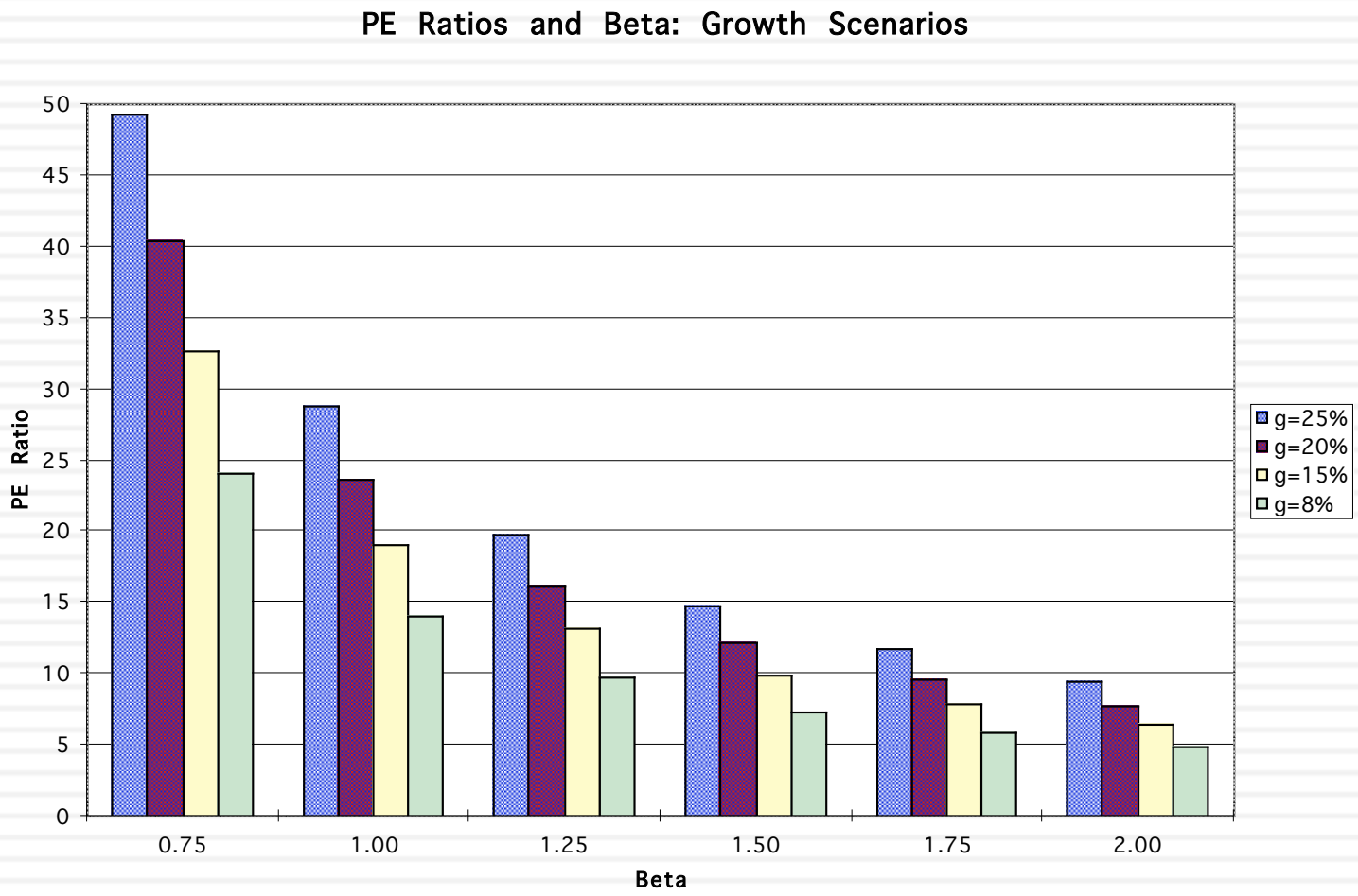
Required rate of return = 6% + 1(5.5%)= 11.5%

$$\frac{P_0}{EPS_0} = \frac{.20*(1.25)*\left(1-\frac{(1.25)^5}{(1.115)^5}\right)}{.115-.25} + \frac{.50*(1.25)^5*(1.08)}{(.115-.08)(1.115)^5} = 28.75$$

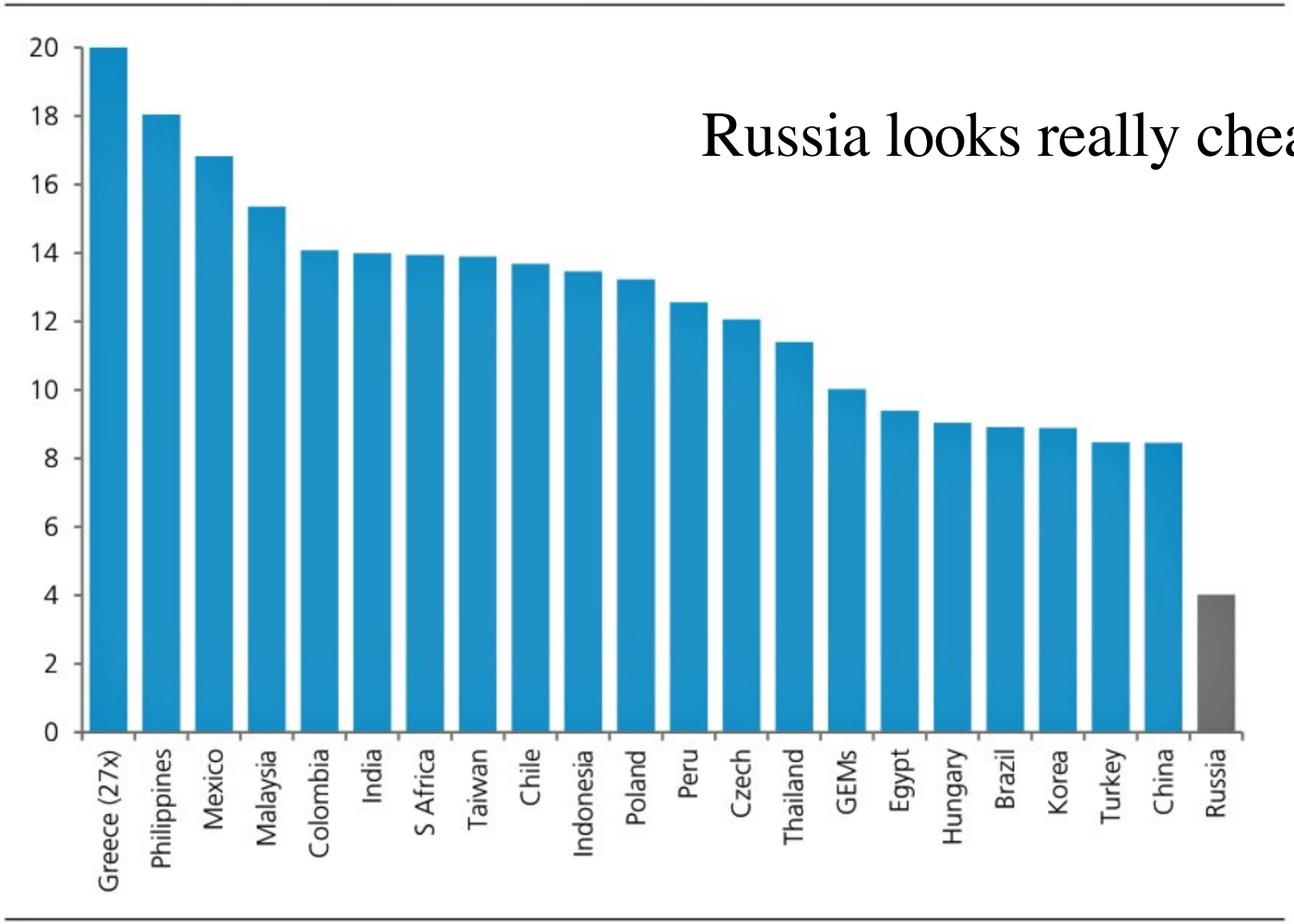
a. PE and Growth: Firm grows at x% for 5 years, 8% thereafter



b. PE and Risk: A Follow up Example



Example 1: Comparing PE ratios across Emerging Markets- March 2014 (pre- Ukraine)



Russia looks really cheap, right?

Source: Datastream, IBES, UBS GEMs Strategy

Example 2: An Old Example with Emerging Markets: June 2000

Country	*PE Ratio*	*Interest Rates*	*GDP Real Growth*	*Country Risk*
Argentina	14	18.00%	2.50%	45
Brazil	21	14.00%	4.80%	35
Chile	25	9.50%	5.50%	15
Hong Kong	20	8.00%	6.00%	15
India	17	11.48%	4.20%	25
Indonesia	15	21.00%	4.00%	50
Malaysia	14	5.67%	3.00%	40
Mexico	19	11.50%	5.50%	30
Pakistan	14	19.00%	3.00%	45
Peru	15	18.00%	4.90%	50
Phillipines	15	17.00%	3.80%	45
Singapore	24	6.50%	5.20%	5
South Korea	21	10.00%	4.80%	25
Thailand	21	12.75%	5.50%	25
Turkey	12	25.00%	2.00%	35
Venezuela	20	15.00%	3.50%	45

Regression Results

- The regression of PE ratios on these variables provides the following –

  PE = 16.16 - 7.94 Interest Rates
  + 154.40 Growth in GDP
  - 0.1116 Country Risk

  R Squared = 73%

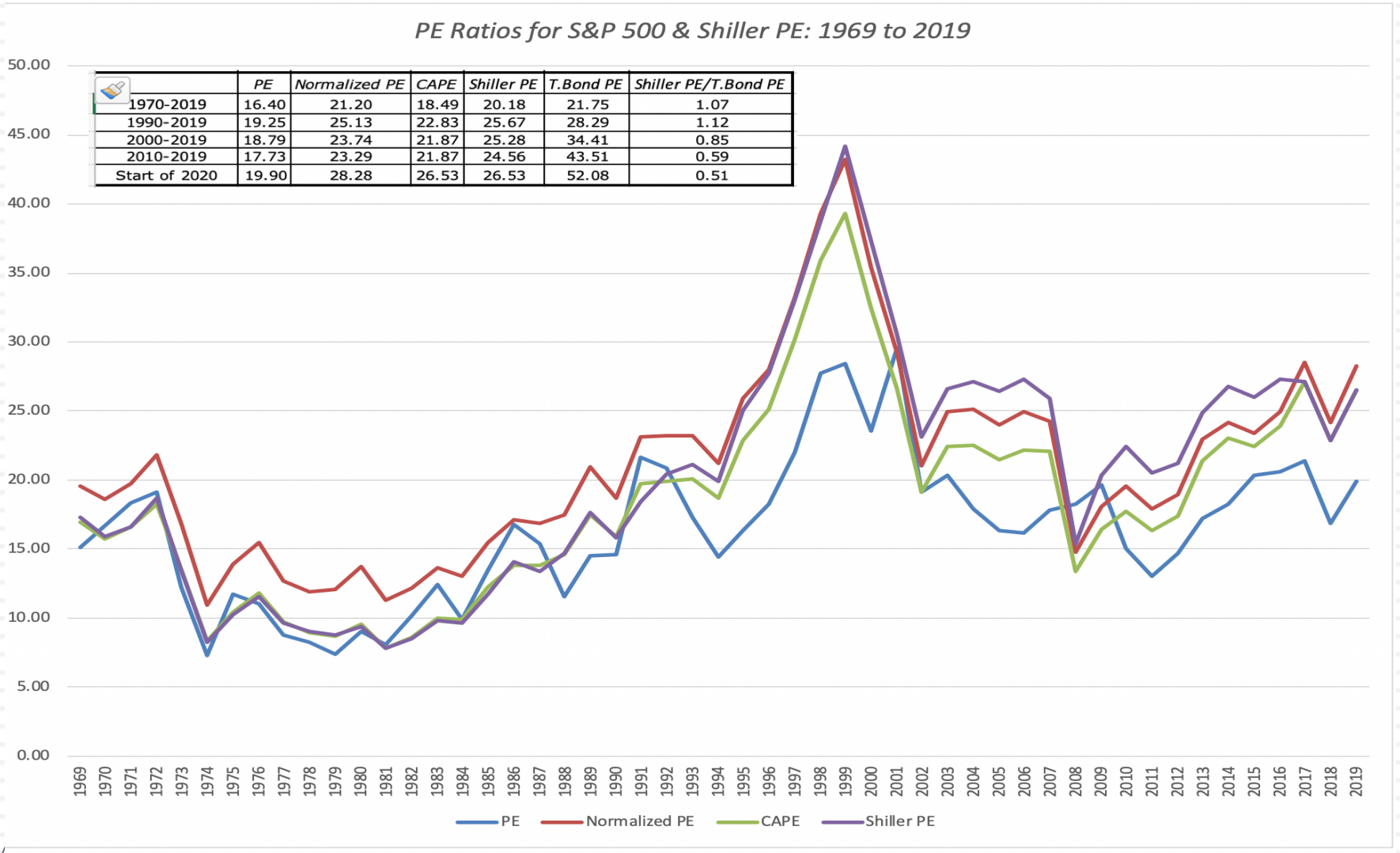
- What do the coefficients tell you about how each of these variables play into PE ratio differences across countries?

Predicted PE Ratios

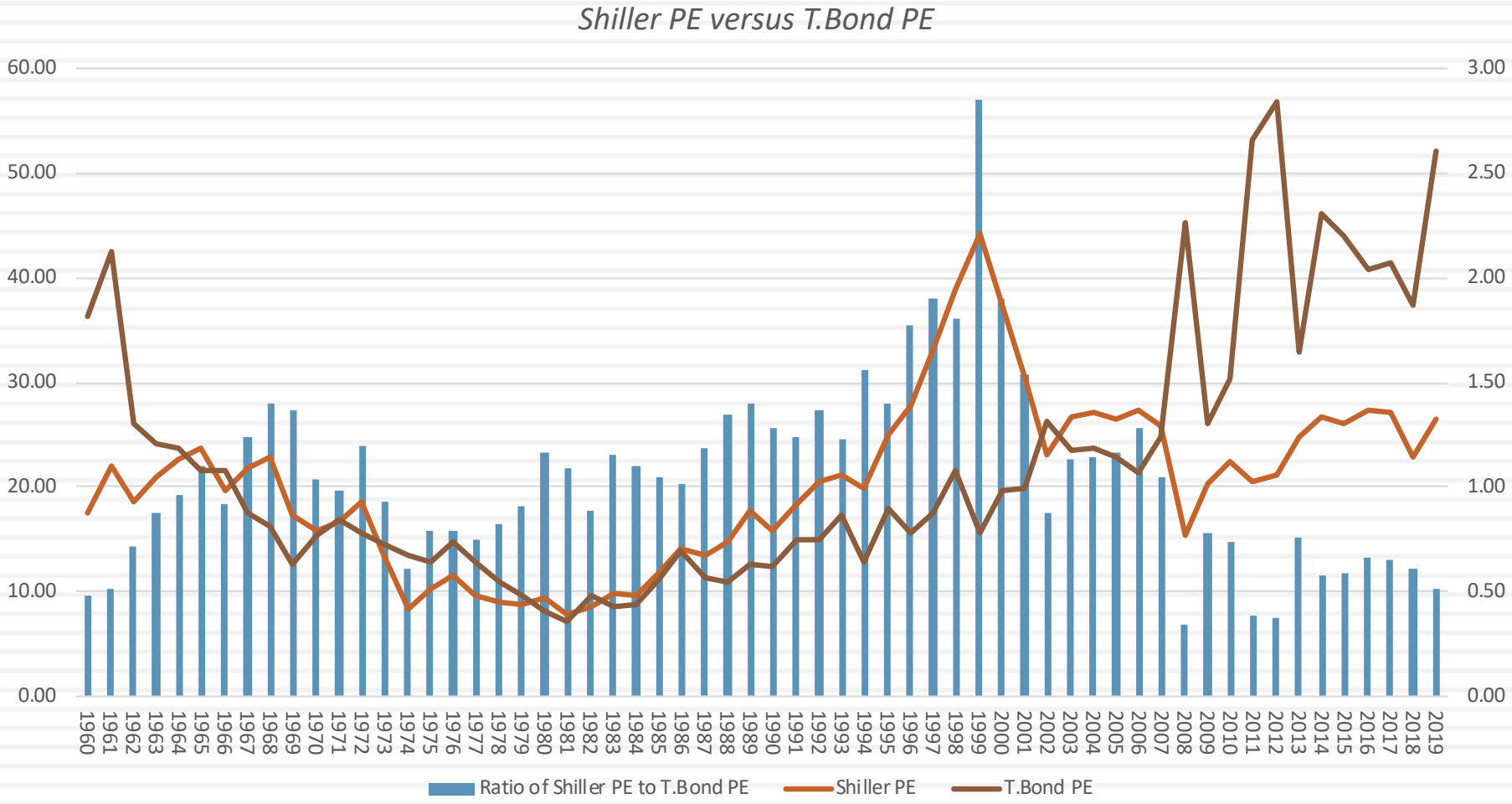
Country	*PE Ratio*	*Interest Rates*	*GDP Real Growth*	*Country Risk*	*Predicted PE*
Argentina	14	18.00%	2.50%	45	13.57
Brazil	21	14.00%	4.80%	35	18.55
Chile	25	9.50%	5.50%	15	22.22
Hong Kong	20	8.00%	6.00%	15	23.11
India	17	11.48%	4.20%	25	18.94
Indonesia	15	21.00%	4.00%	50	15.09
Malaysia	14	5.67%	3.00%	40	15.87
Mexico	19	11.50%	5.50%	30	20.39
Pakistan	14	19.00%	3.00%	45	14.26
Peru	15	18.00%	4.90%	50	16.71
Phillipines	15	17.00%	3.80%	45	15.65
Singapore	24	6.50%	5.20%	5	23.11
South Korea	21	10.00%	4.80%	25	19.98
Thailand	21	12.75%	5.50%	25	20.85
Turkey	12	25.00%	2.00%	35	13.35
Venezuela	20	15.00%	3.50%	45	15.35

Example 3: US Stocks are expensive, just look at the PE ratio

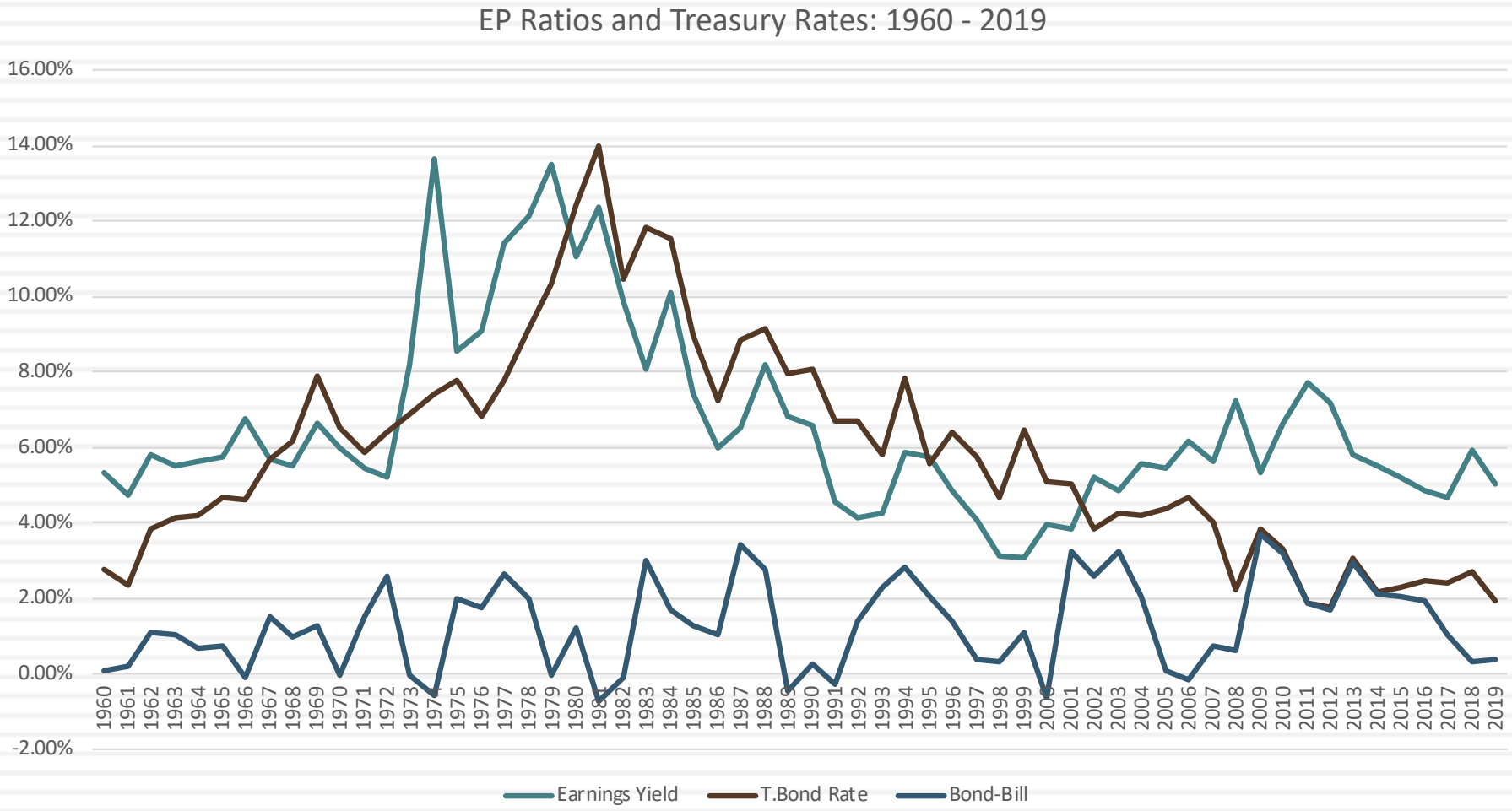
	PE	Normalized PE	CAPE	Shiller PE	T.Bond PE	Shiller PE/T.Bond PE
1970-2019	16.40	21.20	18.49	20.18	21.75	1.07
1990-2019	19.25	25.13	22.83	25.67	28.29	1.12
2000-2019	18.79	23.74	21.87	25.28	34.41	0.85
2010-2019	17.73	23.29	21.87	24.56	43.51	0.59
Start of 2020	19.90	28.28	26.53	26.53	52.08	0.51



A Counter: No, they are cheap, relative to the alternatives..



The Tie Breaker: E/P Ratios , T.Bond Rates and Term Structure: Updated..



Regression Results

	EP	T.Bond	T.Bill
EP	1.0000		
T.Bond	0.6214	1.0000	
Bond - Bill	-0.1283	-0.0739	1.0000

Correlation between E/P and interest rates

- In the following regression, using 1960-2019 data, we regress E/P ratios against the level of T.Bond rates and a term structure variable (T.Bond - T.Bill rate)

  EP Ratio = 0.0373 + 0.5222 T.Bond Rate - 0.1718 (T.Bond Rate - T.Bill Rate)
  (5.71) (5.95) (-0.80)

  R squared = 39.29%

- Going back to 2008, this is what the regression looked like:

  E/P = 2.56% + 0.7044 T.Bond Rate – 0.3289 (T.Bond Rate-T.Bill Rate)
  (4.71) (7.10) (1.46)

  R squared = 50.71%

  The R-squared has dropped and the differential with the T.Bill rate has lost significance. How would you read this result?

II. PEG Ratio

- PEG Ratio = PE ratio/ Expected Growth Rate in EPS
  - For consistency, you should make sure that your earnings growth reflects the EPS that you use in your PE ratio computation.
  - The growth rates should preferably be over the same time period.
- To understand the fundamentals that determine PEG ratios, let us return again to a 2-stage equity discounted cash flow model:

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

- 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:

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

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

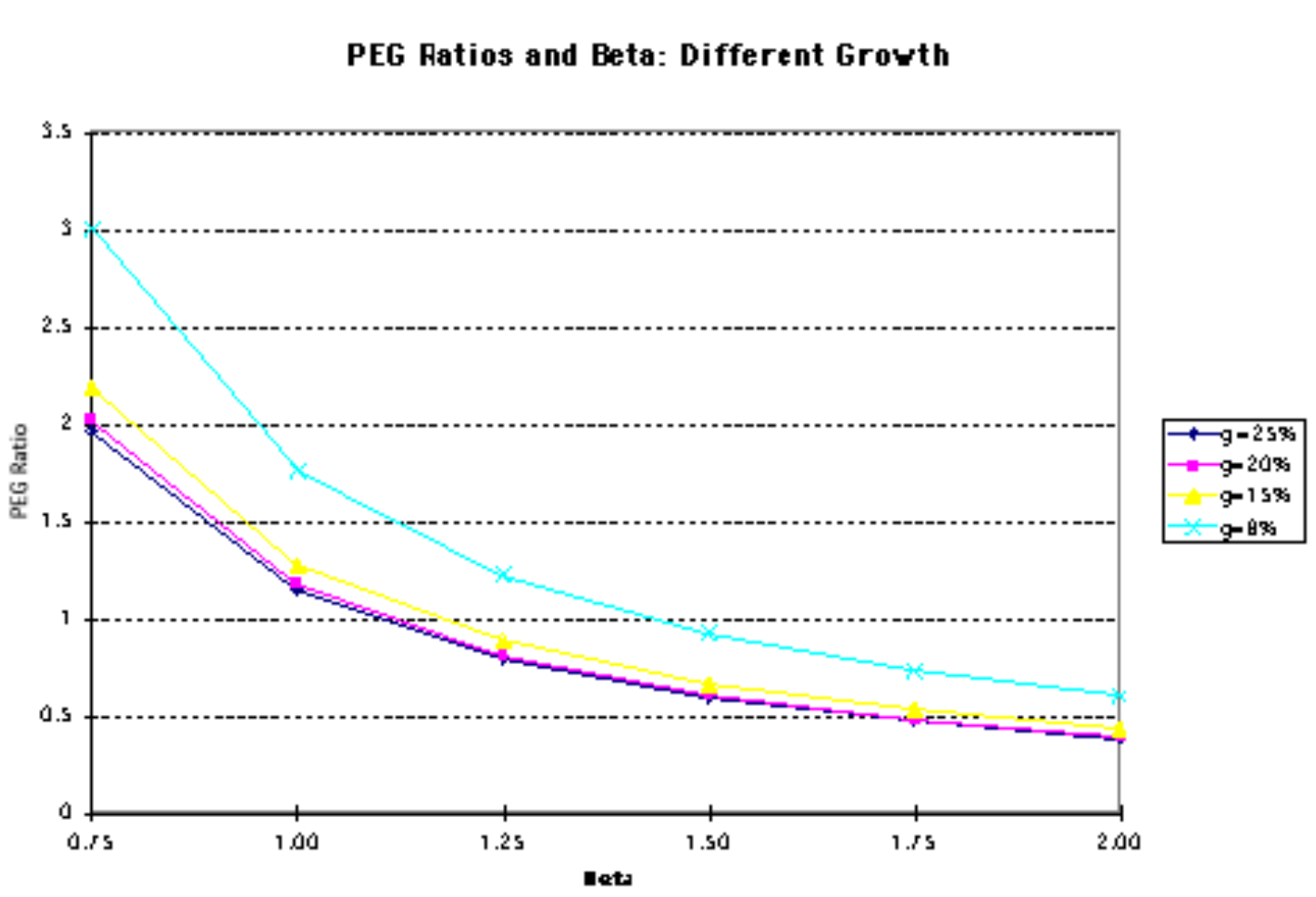
- Assume that you have been asked to estimate the PEG ratio for a firm which has the following characteristics:

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

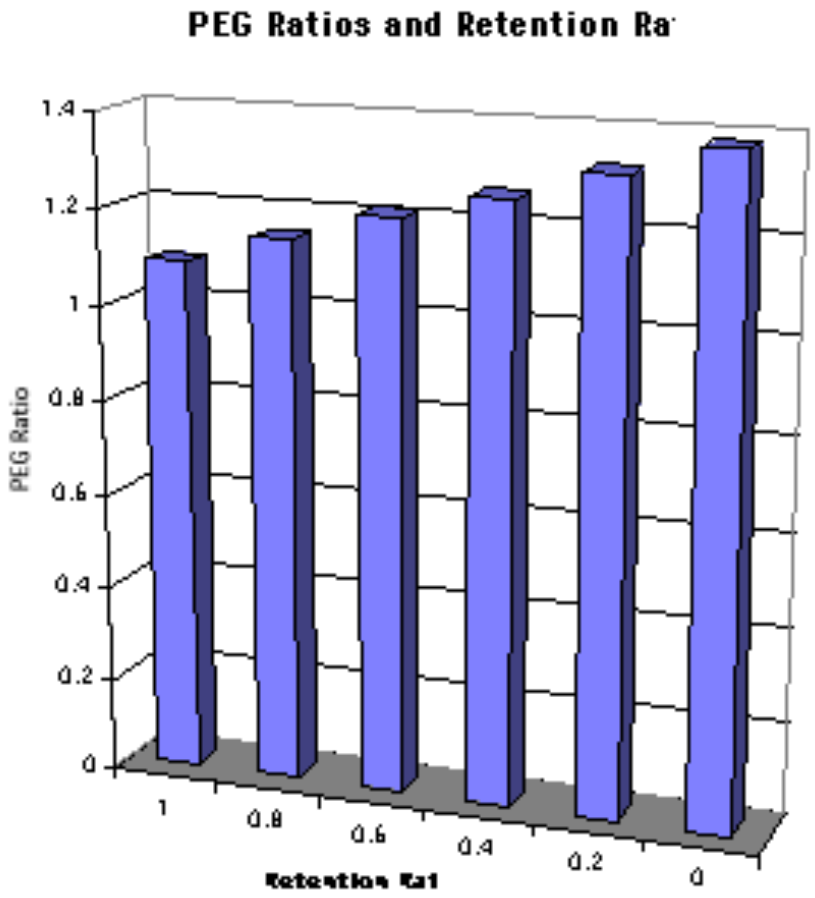
- Riskfree rate = T.Bond Rate = 6%
- Required rate of return = 6% + 1(5.5%)= 11.5%
- The PEG ratio for this firm can be estimated as follows:

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

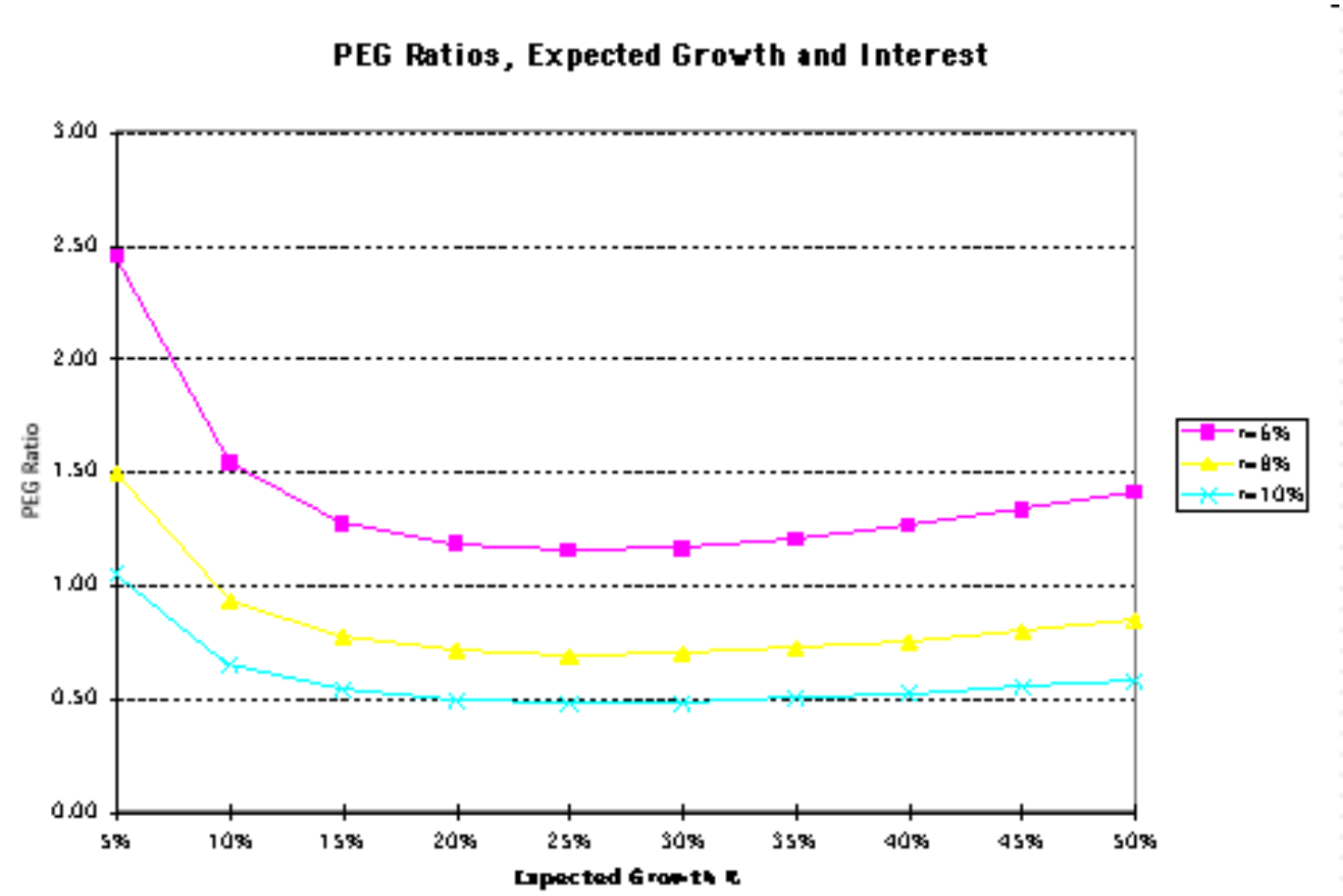
PEG Ratios and Risk



PEG Ratios and 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.

III. Price to Book Ratio

- Going back to a simple dividend discount model,

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

- Defining the return on equity (ROE) = EPS0 / 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,

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

Price Book Value Ratio: Stable Growth Firm Another Presentation

- This formulation can be simplified even further by relating growth to the return on equity:

$$g = (1 - \text{Payout ratio}) * ROE$$

- Substituting back into the P/BV equation,

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

- The price-book value ratio of a stable firm is determined by the differential between the return on equity and the required rate of return on its projects.
- Building on this equation, a company that is expected to generate a ROE higher (lower than, equal to) its cost of equity should trade at a price to book ratio higher (less than, equal to) one.

Now changing to an Enterprise value multiple EV/ Book Capital

- To see the determinants of the value/book ratio, consider the simple free cash flow to the firm model:

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

- Dividing both sides by the book value, we get:

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

- If we replace, FCFF = EBIT(1-t) - (g/ROC) EBIT(1-t),we get:

$$\frac{V_0}{BV} = \frac{ROC - g}{WACC-g}$$