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*	*Stable Growth*
Expected Growth Rate	15%	1.5%
Payout Ratio	25%	92.5% (based on ROE = 20%)
Beta	1.00	1.00
Number of years	5 years	Forever after year 5

- Riskfree rate = Treasury Bond Rate = 1.5%, ERP = 5%
- Required rate of return = 1.5% + 1(5%)= 6.5%

$$PE = \frac{.25 * 1.15 * \left(1 - \frac{1.15^5}{1.065^5}\right)}{(.065 - .15)} + \frac{.925 * 1.15^5 * (1.015)}{(.065 - .015)(1.065)^5} = 29.15$$

a. PE, Growth and Interest Rates

As interest rates rise, holding all else constant, PE ratios drop, but they drop by more for high growth stocks than low growth stocks.

		Riskfree Rate					*% Change as rate goes*
		0.00%	1.50%	3.00%	4.50%	6.00%	*from 0% to 6%*
Expected Growth Rate - Next 5 years	0.00%	20.00	17.86	15.91	14.13	12.50	37.50%
	3.00%	22.18	19.74	17.51	15.48	13.62	38.59%
	6.00%	24.57	21.79	19.26	16.95	14.84	39.60%
	9.00%	27.19	24.04	21.16	18.54	16.16	40.57%
	12.00%	30.05	26.49	23.24	20.27	17.38	42.16%
	15.00%	33.17	29.15	25.48	22.15	19.11	42.39%
	18.00%	36.57	32.04	27.92	24.17	20.75	43.26%
	21.00%	40.25	35.18	30.55	26.35	22.52	44.05%
	24.00%	44.25	38.56	33.39	28.69	24.41	44.84%
	27.00%	48.56	42.22	36.45	31.20	26.43	45.57%
	30.00%	53.22	46.16	39.74	33.90	28.58	46.30%
% Change as growth goes from 0% to 30%		166.10%	158.45%	149.78%	139.92%	128.64%	

Earnings growth surprises have a much bigger impact on PE ratios, when interest rates are low, than high.

b. PE and Risk: A Follow up Example

Growth Augmentation
If a firm can increase growth, it should see a payoff in higher PE

Superstars
Combination of low risk and high growth

Beta	Expected Growth Rate next 5 years				
	5.00%	10.00%	15.00%	20.00%	25.00%
0.50	43.26	52.68	63.79	76.81	91.96
1.00	21.09	24.83	29.15	34.10	39.75
1.50	13.74	15.67	17.84	20.25	22.91
2.00	10.10	11.17	12.33	13.56	14.84
2.50	7.93	8.53	9.13	9.71	10.24

Risk Reduction
If a firm can reduce its risk, it should see a payoff in higher PE

Investment Dogs
Combination of high risk and low growth

c. PE and Growth Quality: Value Addition and Destruction

For any given growth rate, the higher the ROE, the higher the PE ratio of the stock.

ROE on Investments	Expected Growth Rate for next 5 years				
	5%	10%	15%	20%	25%
5%	13.24	11.19	8.2	4.04	Worthless
10%	18.47	20.28	22.16	24.08	25.99
15%	20.21	23.31	26.82	30.76	35.17
20%	21.09	24.83	29.15	34.1	39.75
25%	21.61	25.74	30.55	36.11	42.5

When ROE < Cost of equity, increasing growth lowers PE ratio

Cost of equity = 6.5%

Example 1: The Cheapest Markets at the start of 2023

Country	Number of firms	sum(Market Cap (in US $))	sum(Total Debt incl leases (in US $))	sum(Firm Value (in US $))	sum(Cash)	sum(Enterprise Value (in US $))	median(Current PE)
Ghana	19	$4,208	$1,192	$5,400	$2,211	$3,189	5.41
Uganda	9	$1,996	$598	$2,594	$416	$2,178	5.83
Ukraine	5	$2,272	$1,781	$4,053	$1,862	$2,192	6.66
Pakistan	426	$43,209	$45,633	$88,842	$11,923	$76,919	6.81
Zambia	15	$1,465	$147	$1,612	$150	$1,462	6.83
Namibia	8	$2,392	$1,039	$3,431	$712	$2,719	6.97
Nigeria	117	$44,004	$22,141	$66,144	$19,537	$46,608	8.13
Serbia	25	$2,841	$1,018	$3,859	$955	$2,904	8.15
Kazakhstan	13	$19,640	$3,929	$23,569	$3,216	$20,353	8.39
Kenya	50	$22,370	$6,958	$29,328	$2,329	$26,999	8.63
British Virgir	26	$4,260	$2,245	$6,505	$353	$6,152	9.23
Slovenia	24	$10,679	$4,040	$14,720	$2,392	$12,328	9.88

Example 2: Controlling for differences - 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%

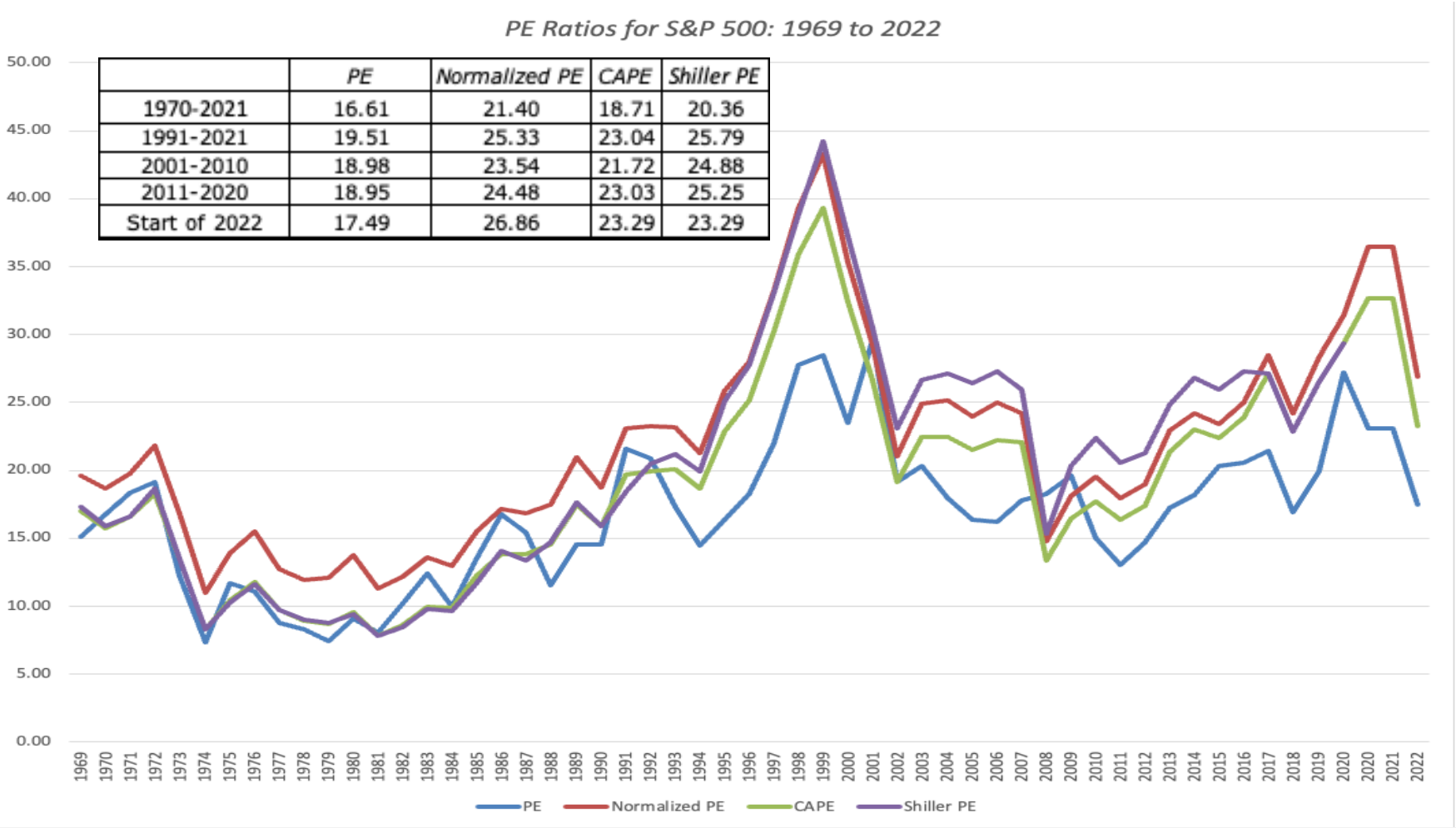
- What do the coefficients tell you about how each of these variables play into PE ratio differences across countries?

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

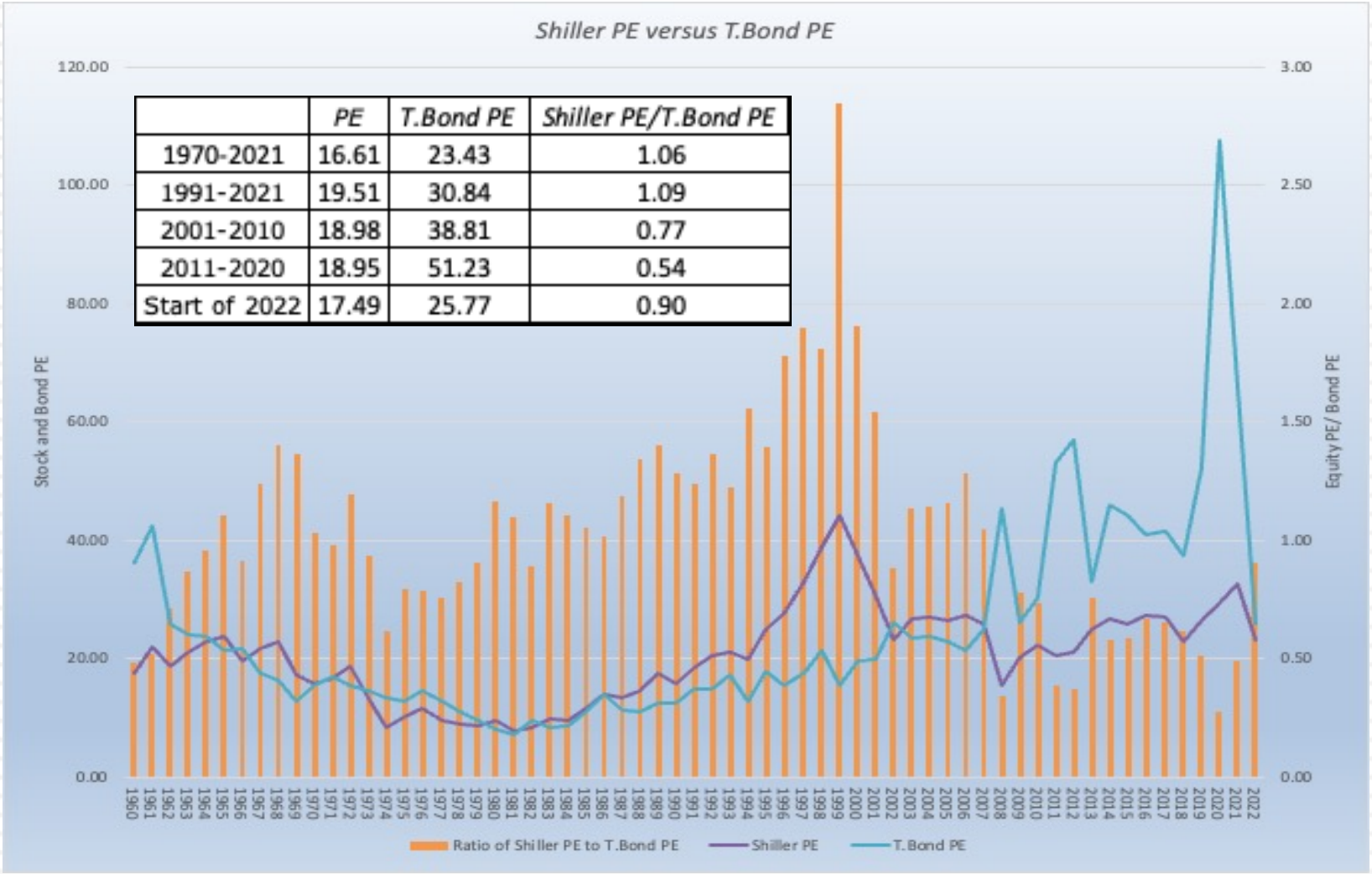
Example 3: Even after 2022, US Stocks are expensive, just look at the PE ratio

	PE	Normalized PE	CAPE	Shiller PE
1970-2021	16.61	21.40	18.71	20.36
1991-2021	19.51	25.33	23.04	25.79
2001-2010	18.98	23.54	21.72	24.88
2011-2020	18.95	24.48	23.03	25.25
Start of 2022	17.49	26.86	23.29	23.29

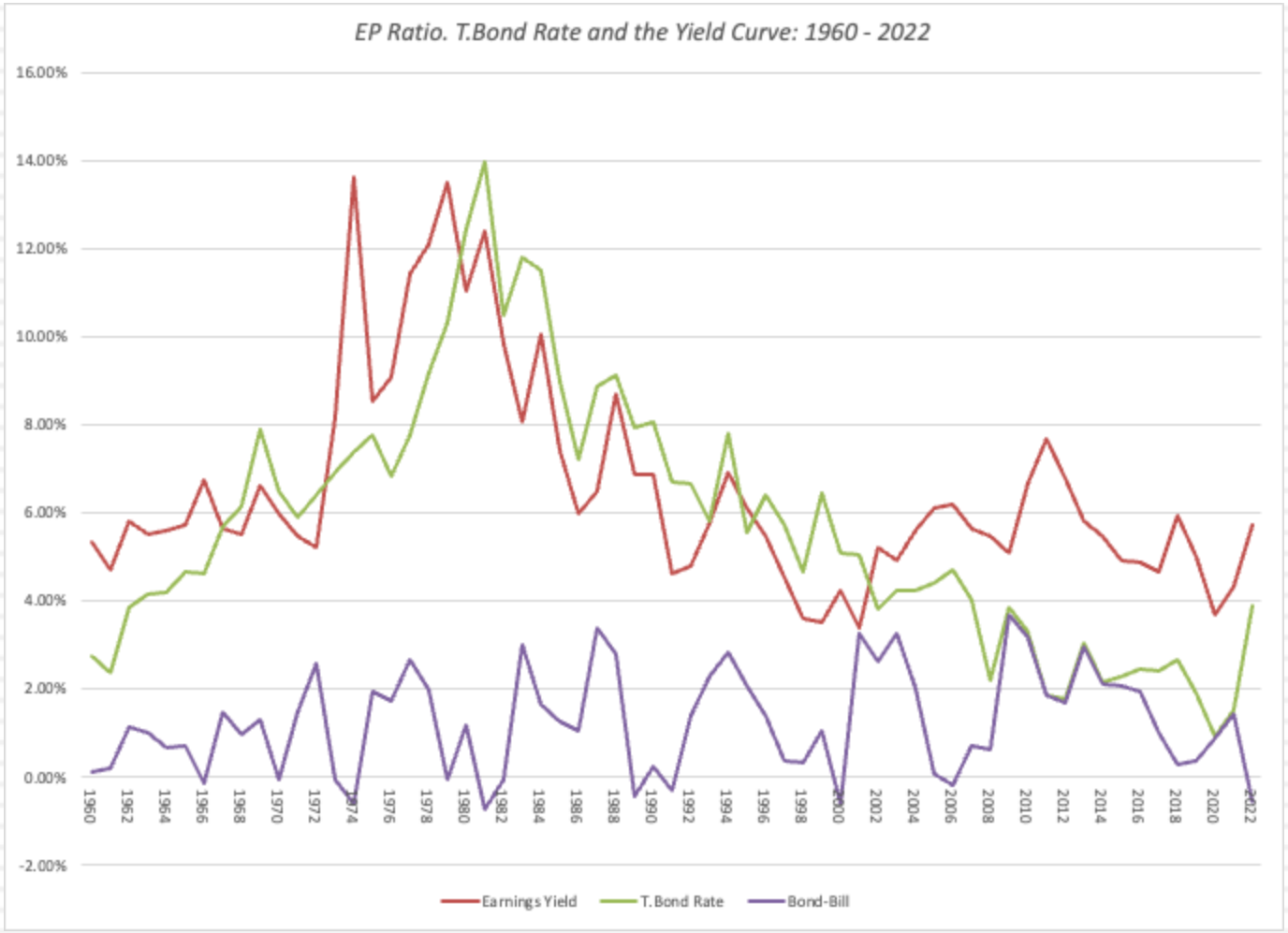


A Counter: No, they are cheap, relative to the alternatives..

	PE	T.Bond PE	Shiller PE/T.Bond PE
1970-2021	16.61	23.43	1.06
1991-2021	19.51	30.84	1.09
2001-2010	18.98	38.81	0.77
2011-2020	18.95	51.23	0.54
Start of 2022	17.49	25.77	0.90



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



Regression Results

	Earnings Yield	*T.Bond Rate*	*Bond-Bill*
Earnings Yield	1.0000		
T.Bond Rate	0.6853	1.0000	
Bond-Bill	-0.1086	-0.0484	1.0000

Correlation between E/P and interest rates

- In the following regression, using 1960-2022 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 = 0.0359 + 0.5528 T.Bond Rate - 0.1534 (T.Bond Rate - T.Bill Rate)
  (6.54) (7.28) (-0.81)

  R squared = 45.78%

- 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

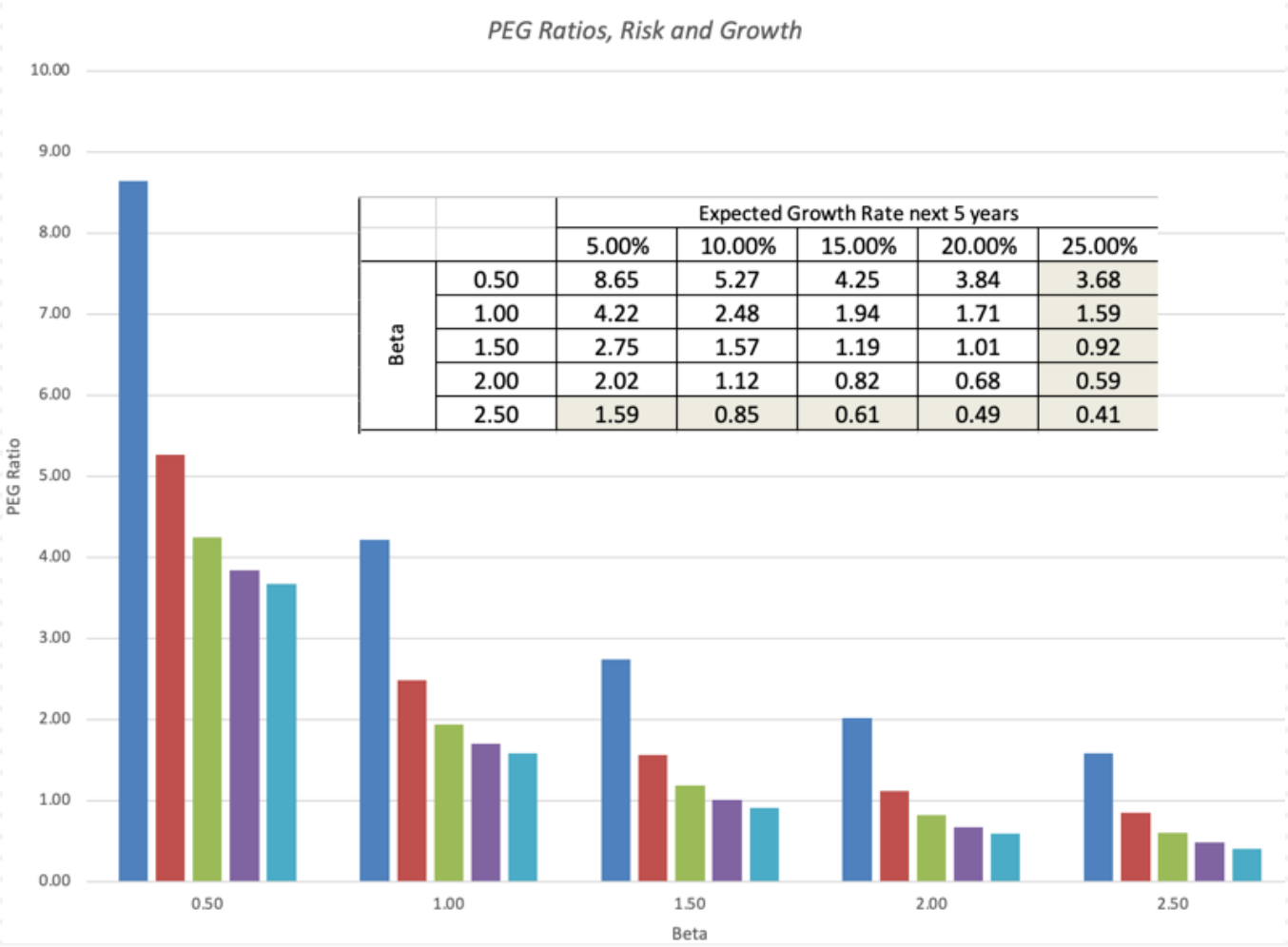
- Assume that you have been asked to estimate the PEG ratio for a firm which has the following characteristics:

Variable	High Growth Phase	Stable Growth Phase
Expected Growth Rate	15%	1.5%
Payout Ratio	25%	92.5%
Beta	1.00	1.00

- Riskfree rate = Treasury Bond Rate = 1.5%, ERP = 5%
- Required rate of return = 1.5% + 1(5%)= 6.5%
- The PEG ratio for this firm can be estimated as follows

$$PEG = \frac{.25 * 1.15 * \left(1 - \frac{1.15^5}{1.065^5}\right)}{.15 * (.065 - .15)} + \frac{.925 * 1.15^5 * (1.015)}{.15(.065 - .015)(1.065)^5} = 1.94$$

a. PEG Ratios are risk-sensitive



Beta	Expected Growth Rate next 5 years				
	5.00%	10.00%	15.00%	20.00%	25.00%
0.50	8.65	5.27	4.25	3.84	3.68
1.00	4.22	2.48	1.94	1.71	1.59
1.50	2.75	1.57	1.19	1.01	0.92
2.00	2.02	1.12	0.82	0.68	0.59
2.50	1.59	0.85	0.61	0.49	0.41

b. PEG Ratios are affected by the Quality of Growth

PEG ratios tend to increase with ROE, for every given growth rate.

		Expected Growth Rate for next 5 years				
		5%	10%	15%	20%	25%
ROE on Investments	5%	2.65	1.12	0.55	0.20	NA
	10%	3.69	2.03	1.48	1.20	1.04
	15%	4.04	2.33	1.79	1.54	1.41
	20%	4.22	2.48	1.94	1.71	1.59
	25%	4.32	2.57	2.04	1.81	1.70

High growth firms with very low ROE can trade at very low PEG ratios.

c. PEG Ratios are not growth neutral…

As **risk free rates rise**, PEG ratios decrease, for every growth rate.

		Riskfree Rate			
		1.50%	3.00%	4.50%	6.00%
Expected Growth first 5 years	3.00%	4.34	3.89	3.48	3.10
	15.00%	1.94	1.70	1.48	1.27
	30.00%	1.54	1.32	1.13	0.95
	45.00%	**1.57**	**1.33**	1.12	0.92
	60.00%	1.73	1.45	**1.20**	**0.97**
	75.00%	1.97	1.63	1.33	1.06

As **growth increases**, PEG ratios initially decline, but at a high-enough growth rate, PEG ratios rise again.

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. Book Value Multiples

- With book value multiples, you scale the market value (which is what the market values your company at) to its book value (which is the accounting estimate of value. It can take two forms:
  - Price to Book = Market Capitalization/ Book Value of Equity
  - EV to Invested Capital = Enterprise Value/ (Book Value of Equity + Book Value of Debt – Cash)
- To the extent that you believe that accountants have a better (or a more conservative) estimate of value, or that book value is a proxy for liquidation value, a company that trades at below its book value is cheap.

Price to Book Ratio: Determinants

- 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:

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

IV. EV to EBITDA multiples

- With EV to EBITDA multiples, you scale enterprise value to earnings before interest, taxes, depreciation and amortization:
  - EV to EBITDA = Enterprise Value/ EBITDA
  - There are variants where even more gets added back, including stock-based compensation and R&D
- EV to EBITDA multiples have become far more widely used in the last four decades than they used to be for both good and bad reasons:
  - The good reasons include less sampling bias (since fewer companies have negative EBITDA) and that it is based on cash flows.
  - The bad reason is that it will give you lower absolute numbers than PE ratios, and for those without perspective, that may signify cheapness.

EV to EBITDA - Determinants

- The value of the operating assets of a firm can be written as:

$$EV_0 = \frac{FCFF_1}{WACC - g}$$

- Now the value of the firm can be rewritten as

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

- Dividing both sides of the equation by EBITDA,

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

- The determinants of EV/EBITDA are:
  - The cost of capital
  - Expected growth rate
  - Tax rate
  - Reinvestment rate (or ROC)

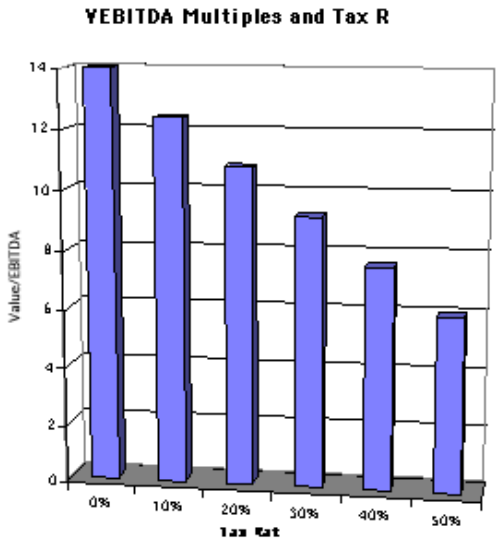
A Simple Example

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

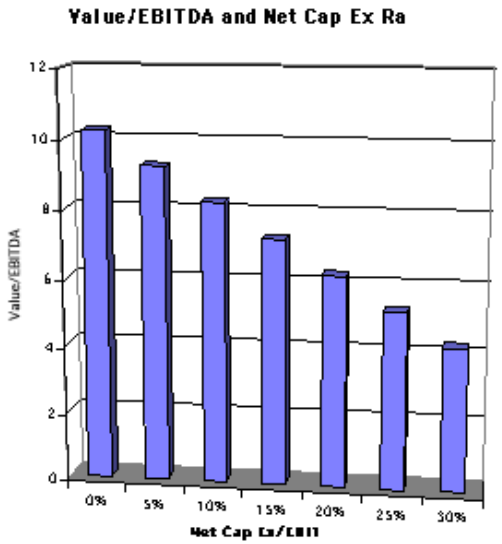
$$\frac{\text{Value}}{\text{EBITDA}} = \frac{(1-.36)}{.10-.05} + \frac{(0.2)(.36)}{.10-.05} - \frac{0.3}{.10-.05} - \frac{0}{.10-.05} = 8.24$$

The Determinants of EV/EBITDA

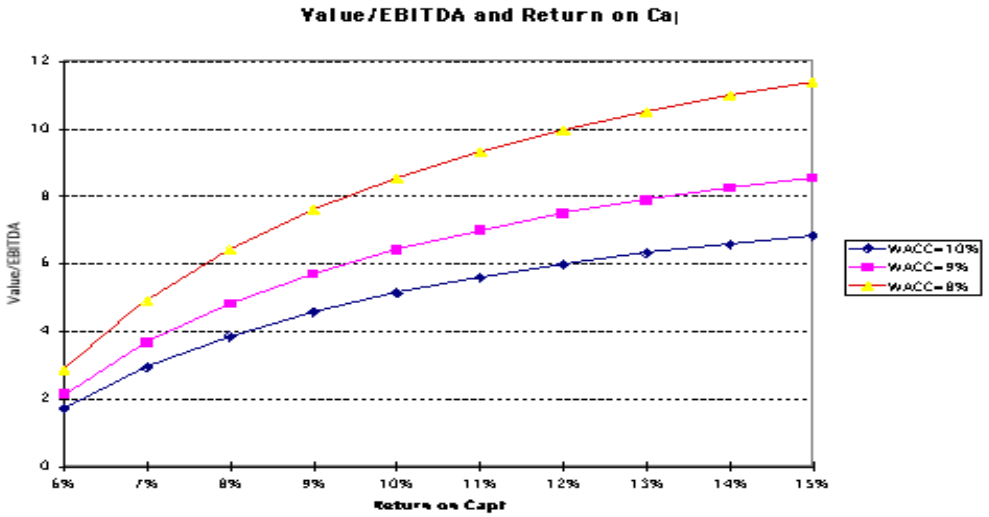
Tax Rates



Reinvestment Needs



Excess Returns



V. Revenue Multiples

- With revenue multiples, you scale market value to the revenues generated by a firm. There are two variants in use:
  - Price to Sales = Market Capitalization / Sales
  - EV to Sales = Enterprise Value / Sales
- The former, while widely used, is internally inconsistent and can be misleading for firms with significant debt loads and/or cash holdings.
- The biggest selling point for revenue multiples is that you lose far fewer firms when computing the multiple, since revenues cannot be negative.

EV/Sales Ratio: Determinants

- If pre-tax operating margins are used, the appropriate value estimate is that of the firm. In particular, if one makes the replaces the FCFF with the expanded version:
  - Free Cash Flow to the Firm = EBIT (1 - tax rate) (1 - Reinvestment Rate)

$$\frac{\text{Value}}{\text{Sales}_0} = \text{After-tax Oper. Margin} * \left[\frac{(1\text{-RIR}_{\text{growth}})(1+g) * \left(1 - \frac{(1+g)^n}{(1+\text{WACC})^n}\right)}{\text{WACC-g}} + \frac{(1\text{-RIR}_{\text{stable}})(1+g)^n * (1+g_n)}{(\text{WACC-g}_n)(1+\text{WACC})^n} \right]$$

g = Growth rate in after-tax operating income for the first n years

gn = Growth rate in after-tax operating income after n years forever (Stable growth rate)

$\text{RIR}_{\text{Growth, Stable}}$ = Reinvestment rate in high growth and stable periods

WACC = Weighted average cost of capital

The value of a brand name

- One of the critiques of traditional valuation is that is fails to consider the value of brand names and other intangibles.
  - The approaches used by analysts to value brand names are often ad-hoc and may significantly overstate or understate their value.
  - One of the benefits of having a well-known and respected brand name is that firms can charge higher prices for the same products, leading to higher profit margins and hence to higher price-sales ratios and firm value. The larger the price premium that a firm can charge, the greater is the value of the brand name.
- In general, the value of a brand name can be written as:
  - Value of brand name $=\{(V/S)_b-(V/S)_g\}^*$ Sales
  - $(V/S)_b$ = Value of Firm/Sales ratio with the benefit of the brand name
  - $(V/S)_g$ = Value of Firm/Sales ratio of the firm with the generic product

Valuing Brand Name

	Coca Cola	*With Cott Margins*
Current Revenues =	$21,962.00	$21,962.00
Length of high-growth period	10	10
Reinvestment Rate =	50%	50%
Operating Margin (after-tax)	15.57%	5.28%
Sales/Capital (Turnover ratio)	1.34	1.34
Return on capital (after-tax)	20.84%	7.06%
Growth rate during period (g) =	10.42%	3.53%
Cost of Capital during period =	7.65%	7.65%
Stable Growth Period		
Growth rate in steady state =	4.00%	4.00%
Return on capital =	7.65%	7.65%
Reinvestment Rate =	52.28%	52.28%
Cost of Capital =	7.65%	7.65%
Value of Firm =	**$79,611.25**	**$15,371.24**

Value of brand name = $79,611 -$15,371 = $64,240 million