

EV/Sales Ratio: Determinants

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- 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)

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

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

g_n = 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

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- One of the critiques of traditional valuation is that it 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 = $\{(V/S)_b - (V/S)_g\} * \text{Sales}$
 - $(V/S)_b$ = 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

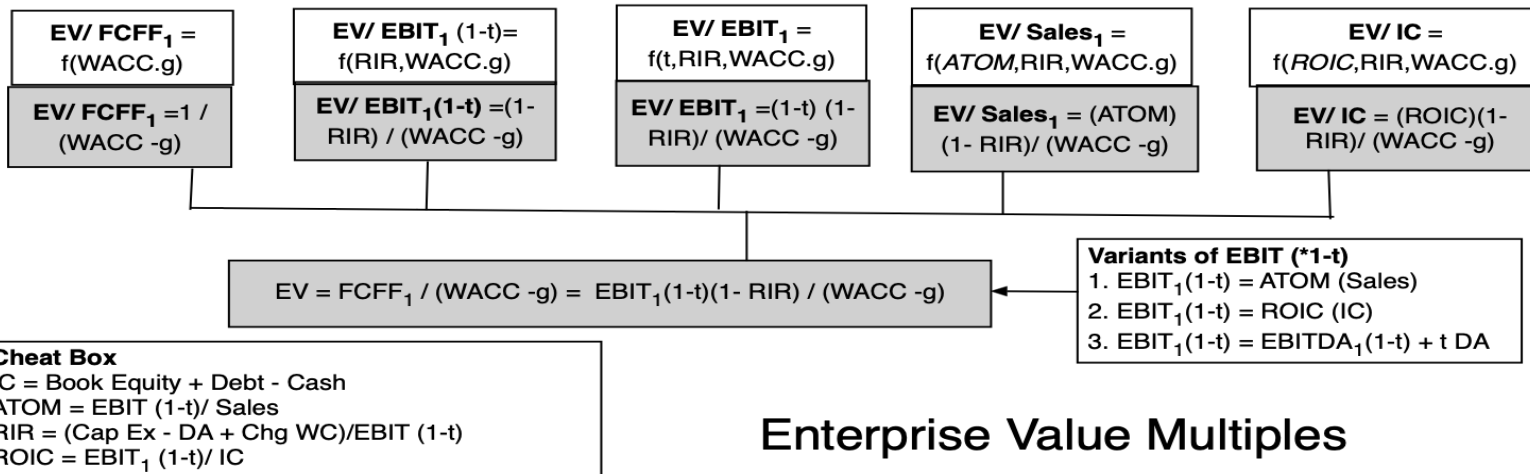
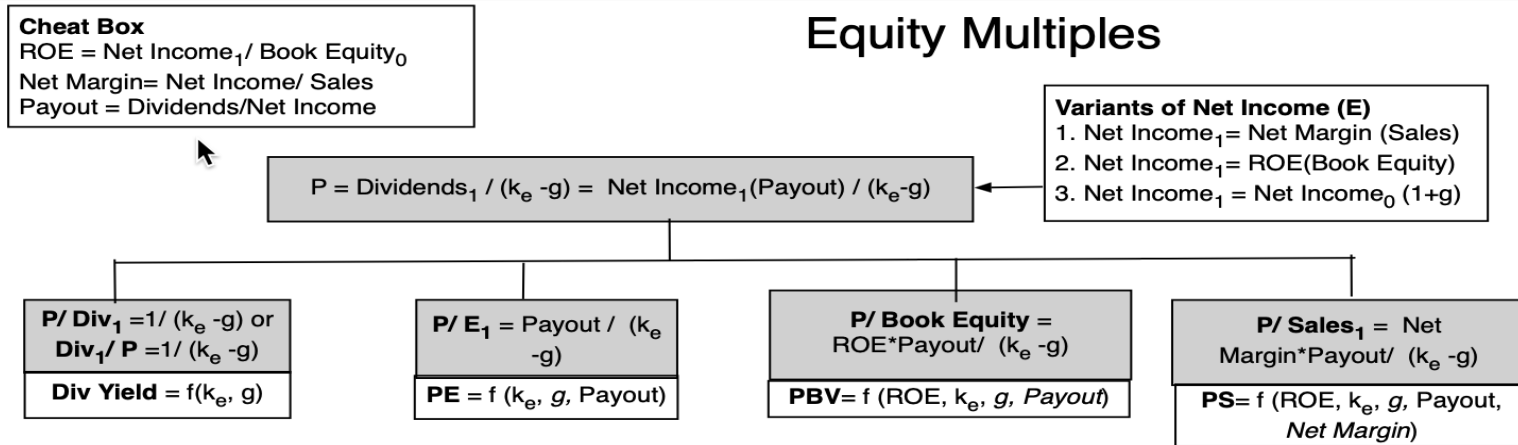
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	<i>Coca Cola</i>	<i>With Cott Margins</i>
Current Revenues =	\$21,962.00	\$21,962.00
Length of high-growth period	10	10
Reinvestment Rate =	50%	50%
Operating Margin (after-tax)	15.57%	5.28%
Sales/Capital (Turnover ratio)	1.34	1.34
Return on capital (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

The Determinants of Multiples...

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Application Tests


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- 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.
 - ▣ 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?
 - ▣ It is impossible to find an exactly identical firm to the one you are valuing.
 - ▣ You need to control for differences across firms.

The Sampling Choice

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- Ideally, you would like to find lots of publicly traded firms that look just like your firm, in terms of fundamentals, and compare the pricing of your firm to the pricing of these other publicly traded firms. Since, they are all just like your firm, there will be no need to control for differences.
- In practice, it is very difficult (and perhaps impossible) to find firms that share the same risk, growth and cash flow characteristics of your firm. Even if you are able to find such firms, they will very few in number. The trade off then becomes:



Small sample of firms that are “just like” your firm

Large sample of firms that are similar in some dimensions but different on others

The “Control for Differences” Choices

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1. Direct comparisons: If the comparable firms are “just like” your firm, you can compare multiples directly across the firms and conclude that your firm is expensive (cheap) if it trades at a multiple higher (lower) than the other firms.
2. Story telling: If there is a key dimension on which the firms vary, you can tell a story based upon your understanding of how value varies on that dimension.

An example: This company trades at 12 times earnings, whereas the rest of the sector trades at 10 times earnings, but I think it is cheap because it has a much higher growth rate than the rest of the sector.
3. Modified multiple: You can modify the multiple to incorporate the dimension on which there are differences across firms.
4. Statistical techniques: If your firms vary on more than one dimension, you can try using multiple regressions (or variants thereof) to arrive at a “controlled” estimate for your firm.

1. Just Story Telling

Trailing PE across Beverage Companies

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<i>Company Name</i>	<i>Trailing PE</i>	<i>Expected Growth</i>	<i>Standard Deviation</i>
Coca-Cola Bottling	29.18	9.50%	20.58%
Molson Inc. Ltd. 'A'	43.65	15.50%	21.88%
Anheuser-Busch	24.31	11.00%	22.92%
Corby Distilleries Ltd.	16.24	7.50%	23.66%
Chalone Wine Group	21.76	14.00%	24.08%
Andres Wines Ltd. 'A'	8.96	3.50%	24.70%
Todhunter Int'l	8.94	3.00%	25.74%
Brown-Forman 'B'	10.07	11.50%	29.43%
Coors (Adolph) 'B'	23.02	10.00%	29.52%
PepsiCo, Inc.	33.00	10.50%	31.35%
Coca-Cola	44.33	19.00%	35.51%
Boston Beer 'A'	10.59	17.13%	39.58%
Whitman Corp.	25.19	11.50%	44.26%
Mondavi (Robert) 'A'	16.47	14.00%	45.84%
Coca-Cola Enterprises	37.14	27.00%	51.34%
Hansen Natural Corp	9.70	17.00%	62.45%

A Question

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- You are reading an equity research report on this sector, and the analyst claims that Andres Wine and Hansen Natural are under valued because they have low PE ratios. Would you agree?
 - a. Yes
 - b. No
- Why or why not?

2: Statistical Controls

Comparing PE ratios across Telecom companies

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

PE, Growth and Risk

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Dependent variable is: PE

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

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

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

Is Telebras under valued?

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- Plugging in Telebras's expected growth rate and the fact that it is an emerging market company into the regression:
 - ▣ Predicted PE = $13.12 + 121.22 (.075) - 13.85 (1) = 8.35$
 - ▣ At an actual price to earnings ratio of 8.9, Telebras is slightly overvalued.
- Bottom line: Just because a company trades at a low PE ratio does not make it cheap.

3: An Eyeballing Exercise

PBV Ratios across European Banks in 2010

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<i>Name</i>	<i>PBV Ratio</i>	<i>Return on Equity</i>	<i>Standard Deviation</i>
BAYERISCHE HYPO-UND VEREINSB	0.80	-1.66%	49.06%
COMMERZBANK AG	1.09	-6.72%	36.21%
DEUTSCHE BANK AG -REG	1.23	1.32%	35.79%
BANCA INTESA SPA	1.66	1.56%	34.14%
BNP PARIBAS	1.72	12.46%	31.03%
BANCO SANTANDER CENTRAL HISP	1.86	11.06%	28.36%
SANPAOLO IMI SPA	1.96	8.55%	26.64%
BANCO BILBAO VIZCAYA ARGENTA	1.98	11.17%	18.62%
SOCIETE GENERALE	2.04	9.71%	22.55%
ROYAL BANK OF SCOTLAND GROUP	2.09	20.22%	18.35%
HBOS PLC	2.15	22.45%	21.95%
BARCLAYS PLC	2.23	21.16%	20.73%
UNICREDITO ITALIANO SPA	2.30	14.86%	13.79%
KREDIETBANK SA LUXEMBOURGEOI	2.46	17.74%	12.38%
ERSTE BANK DER OESTER SPARK	2.53	10.28%	21.91%
STANDARD CHARTERED PLC	2.59	20.18%	19.93%
HSBC HOLDINGS PLC	2.94	18.50%	19.66%
LLOYDS TSB GROUP PLC	3.33	32.84%	18.66%
Average	2.05	12.54%	24.99%
Median	2.07	11.82%	21.93%

The median test...

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- We are looking for stocks that trade at low price to book ratios, while generating high returns on equity, with low risk. But what is a low price to book ratio? Or a high return on equity? Or a low risk
- One simple measure of what is par for the sector are the median values for each of the variables. A simplistic decision rule on under and over valued stocks would therefore be:
 - Undervalued stocks: Trade at price to book ratios below the median for the sector, (2.07), generate returns on equity higher than the sector median (11.82%) and have standard deviations lower than the median (21.93%).
 - Overvalued stocks: Trade at price to book ratios above the median for the sector and generate returns on equity lower than the sector median.

The Statistical Alternative

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- We are looking for stocks that trade at low price to book ratios, while generating high returns on equity. But what is a low price to book ratio? Or a high return on equity?
- Taking the sample of 18 banks, we ran a regression of PBV against ROE and standard deviation in stock prices (as a proxy for risk).

$$\text{PBV} = 2.27 + 3.63 \text{ ROE} - 2.68 \text{ Std dev}$$

(5.56) (3.32) (2.33)

R squared of regression = 79%

- Reading the regression tea leaves:
 - Every 1% increase in the return on equity at a European bank increases its price to book ratio by 0.0363.
 - Every 1% increase in the standard deviation in equity reduces the price to book ratio by 0.0268.
 - The regression predictions will have a standard error, which is inversely proportionate to the R squared.

And these predictions?

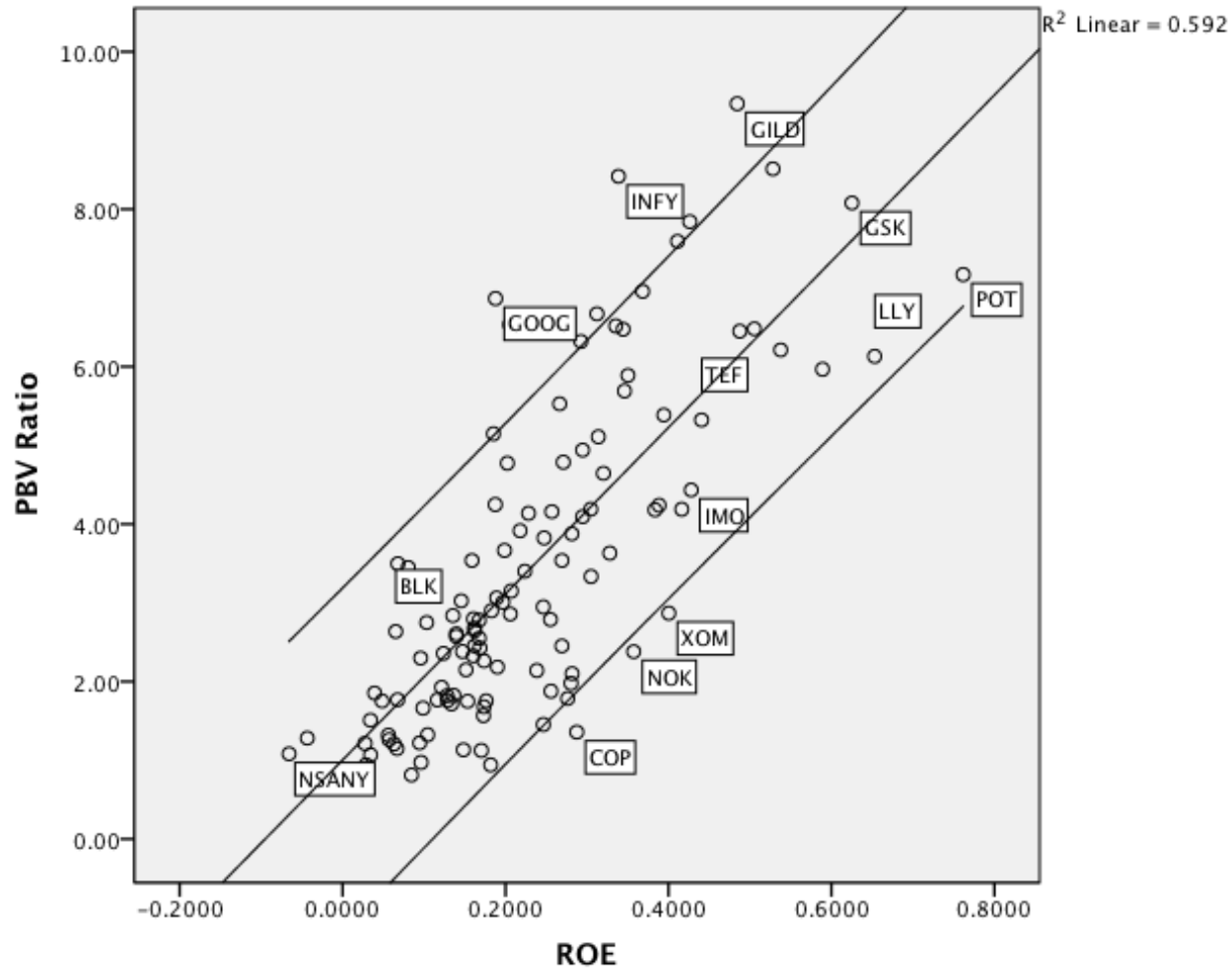
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<i>Name</i>	<i>PBV Ratio</i>	<i>Return on Equity</i>	<i>Standard Deviation</i>	<i>Predicted PBV</i>	<i>Under/Over (%)</i>
BAYERISCHE HYPO-UND VEREINSB	0.80	-1.66%	49.06%	0.89	-10.60%
COMMERZBANK AG	1.09	-6.72%	36.21%	1.05	3.25%
DEUTSCHE BANK AG -REG	1.23	1.32%	35.79%	1.36	-9.26%
BANCA INTESA SPA	1.66	1.56%	34.14%	1.41	17.83%
BNP PARIBAS	1.72	12.46%	31.03%	1.89	-8.75%
BANCO SANTANDER CENTRAL HISP	1.86	11.06%	28.36%	1.91	-2.66%
SANPAOLO IMI SPA	1.96	8.55%	26.64%	1.86	5.23%
BANCO BILBAO VIZCAYA ARGENTA	1.98	11.17%	18.62%	2.17	-9.12%
SOCIETE GENERALE	2.04	9.71%	22.55%	2.02	1.37%
ROYAL BANK OF SCOTLAND GROUP	2.09	20.22%	18.35%	2.51	-16.65%
HBOS PLC	2.15	22.45%	21.95%	2.49	-13.71%
BARCLAYS PLC	2.23	21.16%	20.73%	2.48	-9.96%
UNICREDITO ITALIANO SPA	2.30	14.86%	13.79%	2.44	-5.72%
KREDIETBANK SA LUXEMBOURGEOI	2.46	17.74%	12.38%	2.58	-4.79%
ERSTE BANK DER OESTER SPARK	2.53	10.28%	21.91%	2.05	23.11%
STANDARD CHARTERED PLC	2.59	20.18%	19.93%	2.47	5.00%
HSBC HOLDINGS PLC	2.94	18.50%	19.66%	2.41	21.91%
LLOYDS TSB GROUP PLC	3.33	32.84%	18.66%	2.96	12.40%

Example 4: More Statistics and a Larger Sample

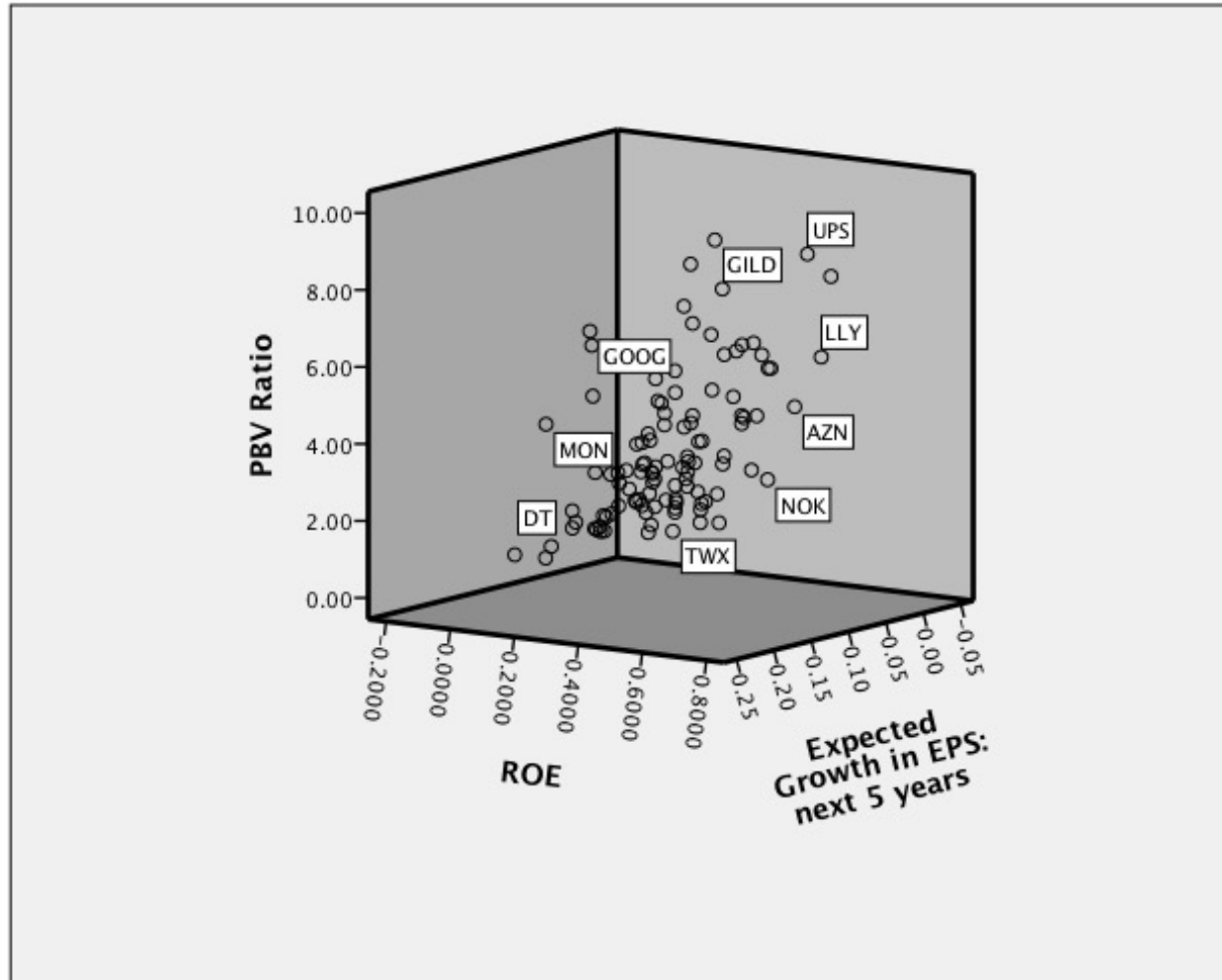
Price to Book versus ROE: Largest firms in the US: January 2010

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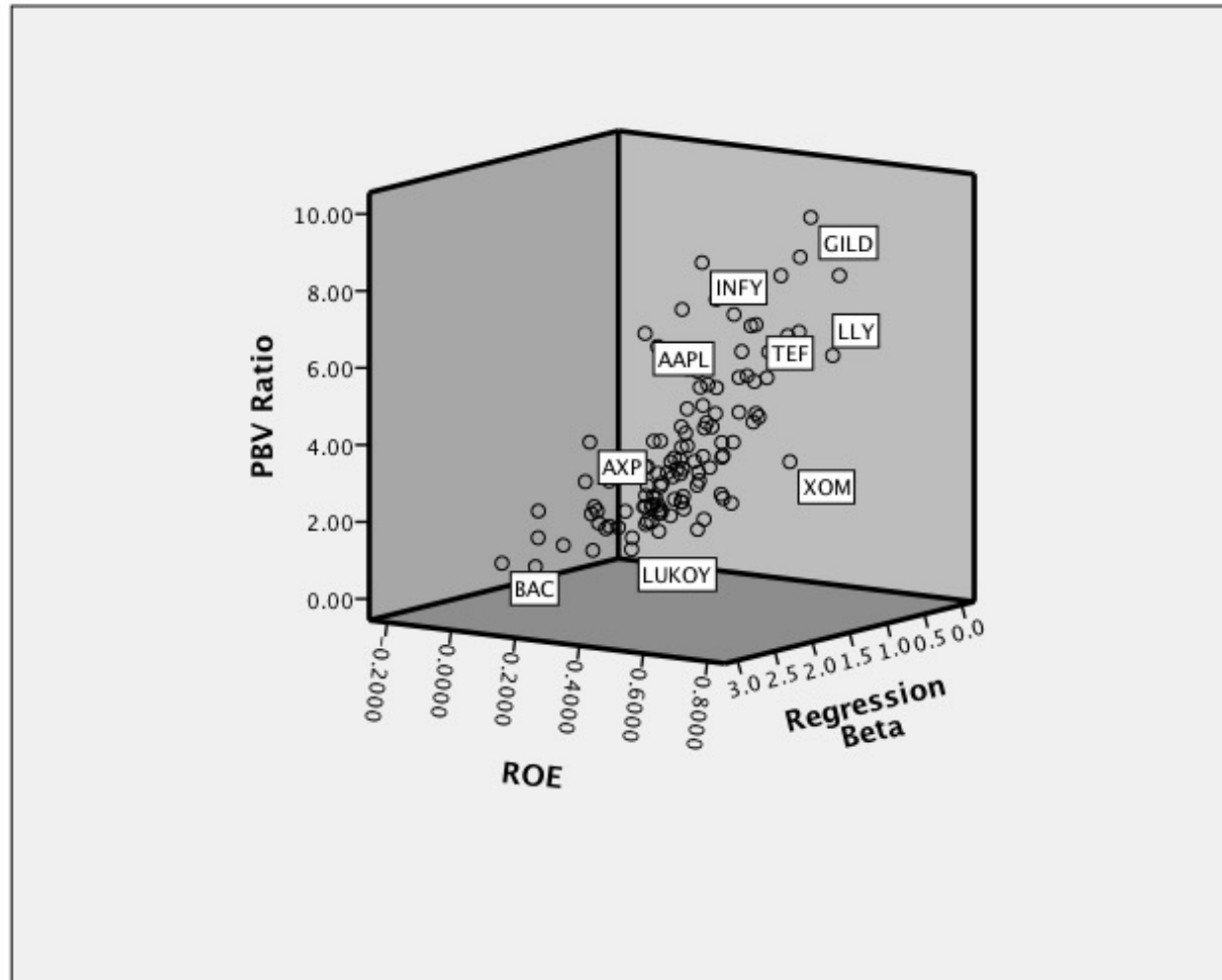
Missing growth?

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PBV, ROE and Risk: Large Cap US firms

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Bringing it all together... Largest US stocks in January 2010

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Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.819 ^a	.670	.661	1.19253

a. Predictors: (Constant), ROE, Expected Growth in EPS: next 5 years, Regression Beta

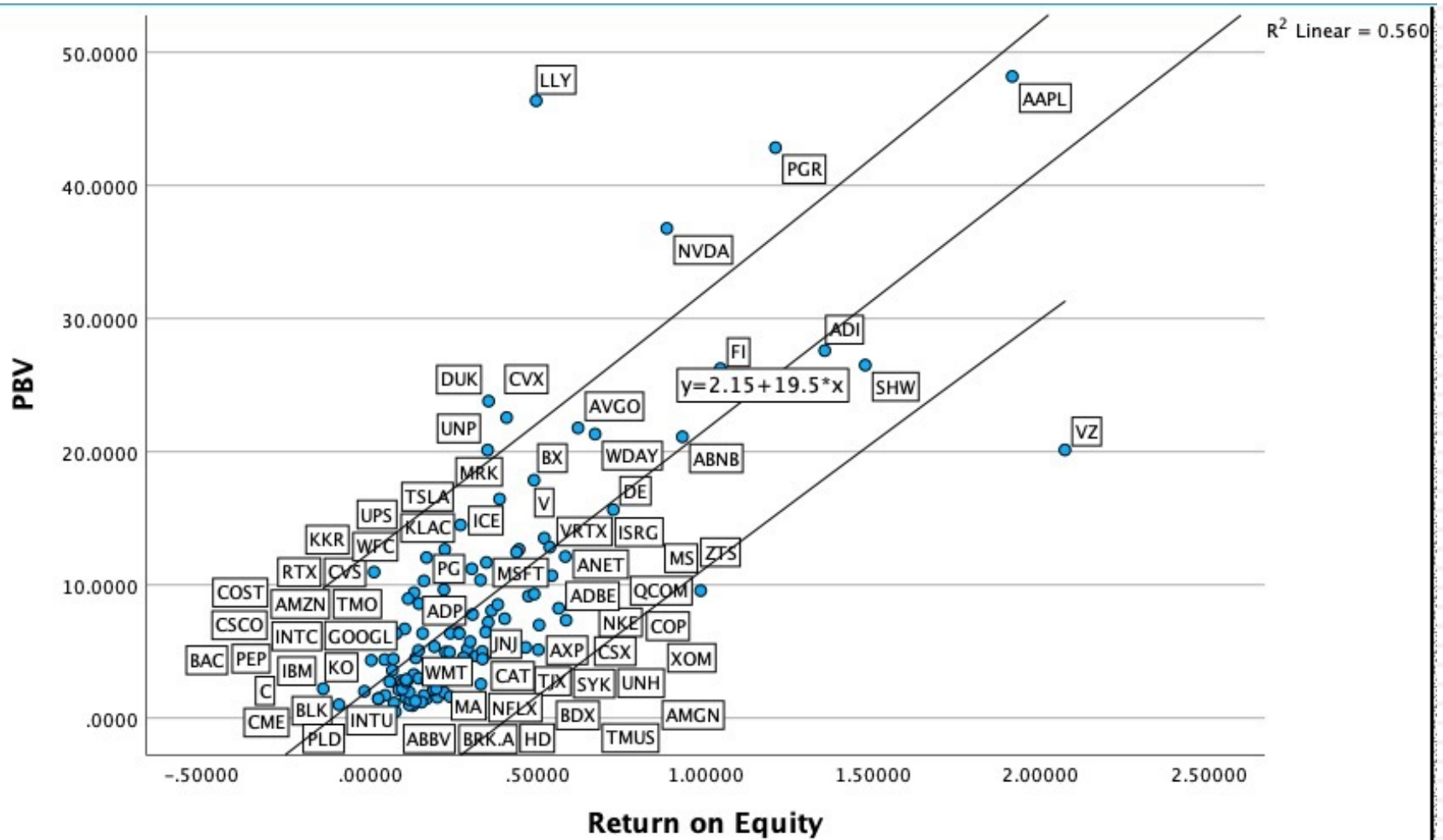
Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.406	.424		.958	.340
	Regression Beta	-.065	.253	-.015	-.256	.799
	Expected Growth in EPS: next 5 years	9.340	2.366	.228	3.947	.000
	ROE	10.546	.771	.777	13.672	.000

a. Dependent Variable: PBV Ratio

Updated PBV Ratios – Largest Market Cap US companies -Updated to January 2024

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Example 5: Overlooked fundamentals?

EV/EBITDA Multiple for Trucking Companies

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<i>Company Name</i>	<i>Value</i>	<i>EBITDA</i>	<i>Value/EBITDA</i>
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
Intrinet 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

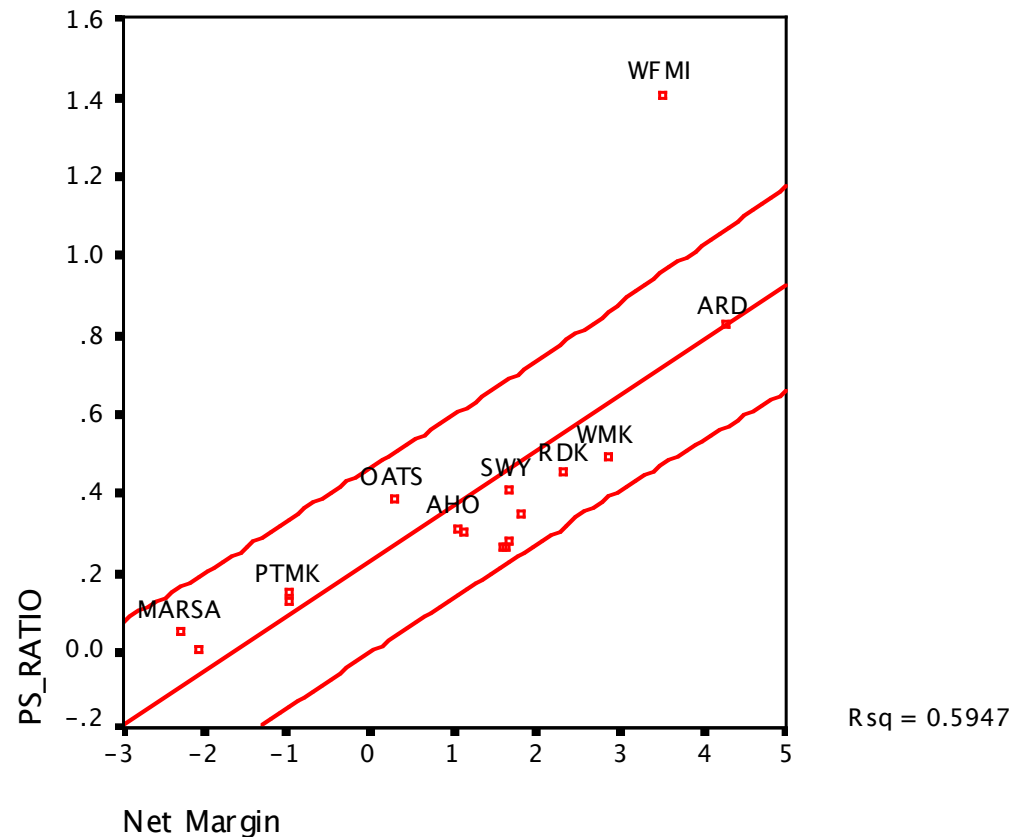
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- Ryder System looks very cheap on a Value/EBITDA multiple basis, relative to the rest of the sector. What explanation (other than misvaluation) might there be for this difference?

- What general lessons would you draw from this on the EV/EBITDA multiples for infrastructure companies as their infrastructure ages?

Example 6: Pricing across time - PS Ratios Grocery Stores - US in January 2007

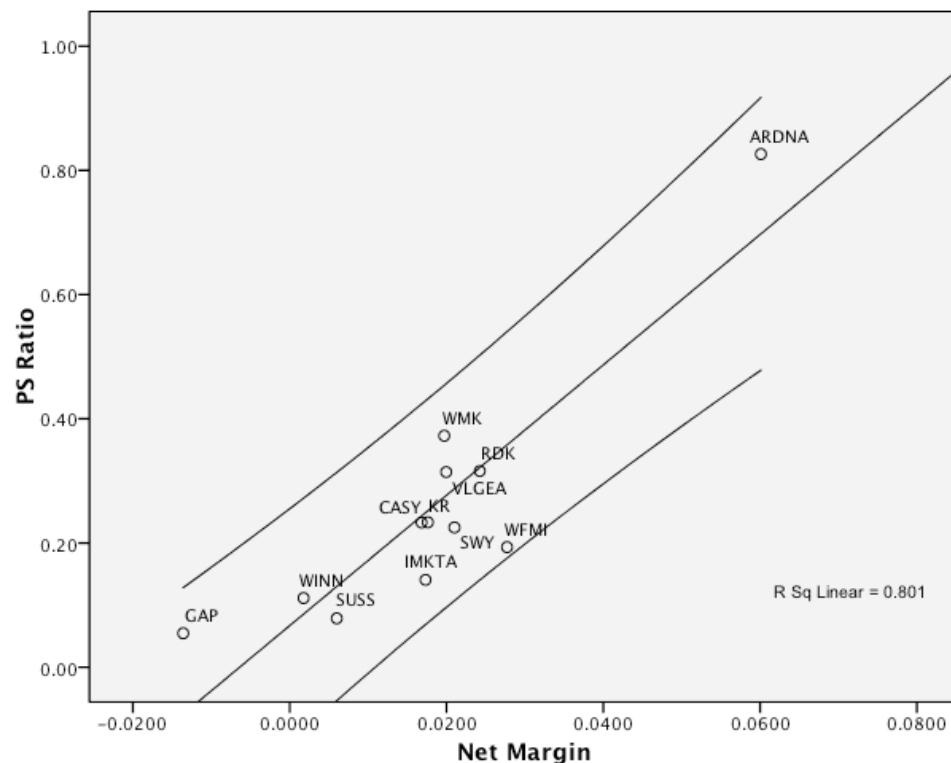
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Whole Foods: In 2007: Net Margin was 3.41% and Price/ Sales ratio was 1.41
Predicted Price to Sales = $0.07 + 10.49 (0.0341) = 0.43$

The difference two years can make: Grocery Stores - US in January 2009

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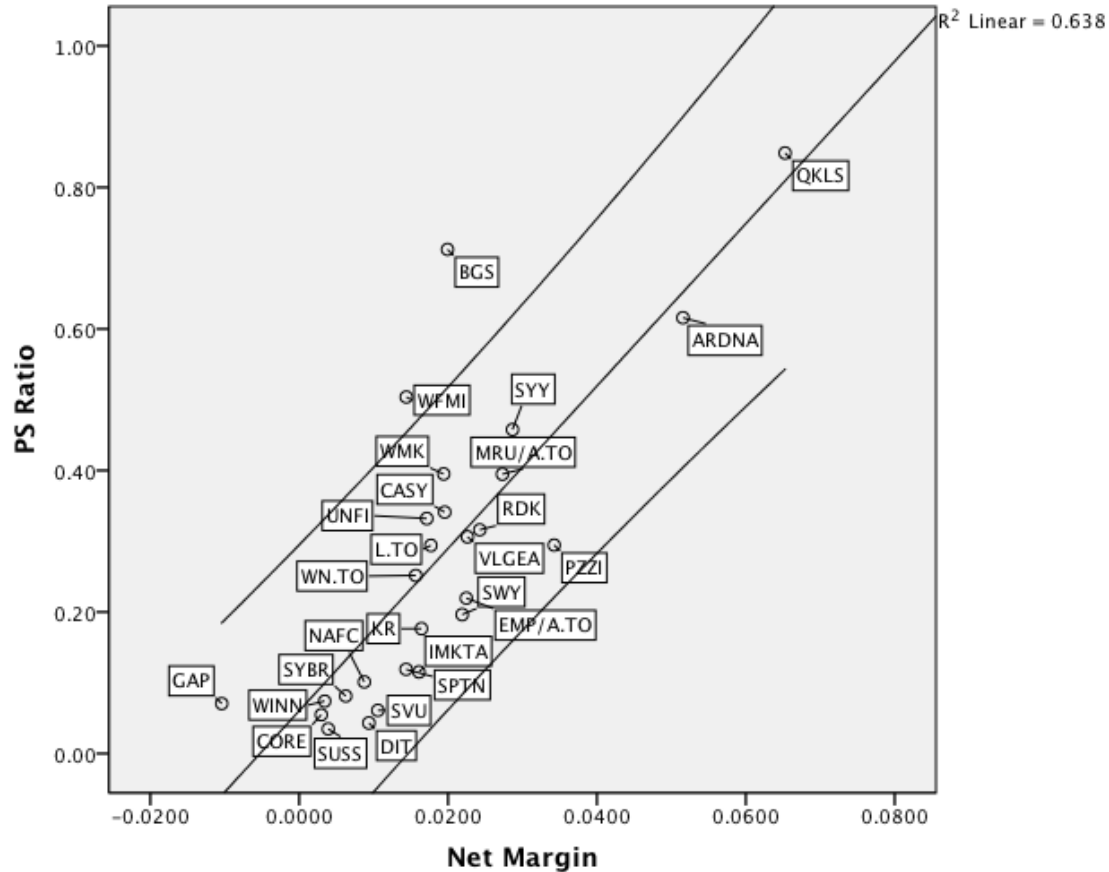


Whole Foods: In 2009, Net Margin had dropped to 2.77% and Price to Sales ratio was down to 0.31.

$$\text{Predicted Price to Sales} = 0.07 + 10.49 (.0277) = 0.36$$

Is this steady State? In 2010..

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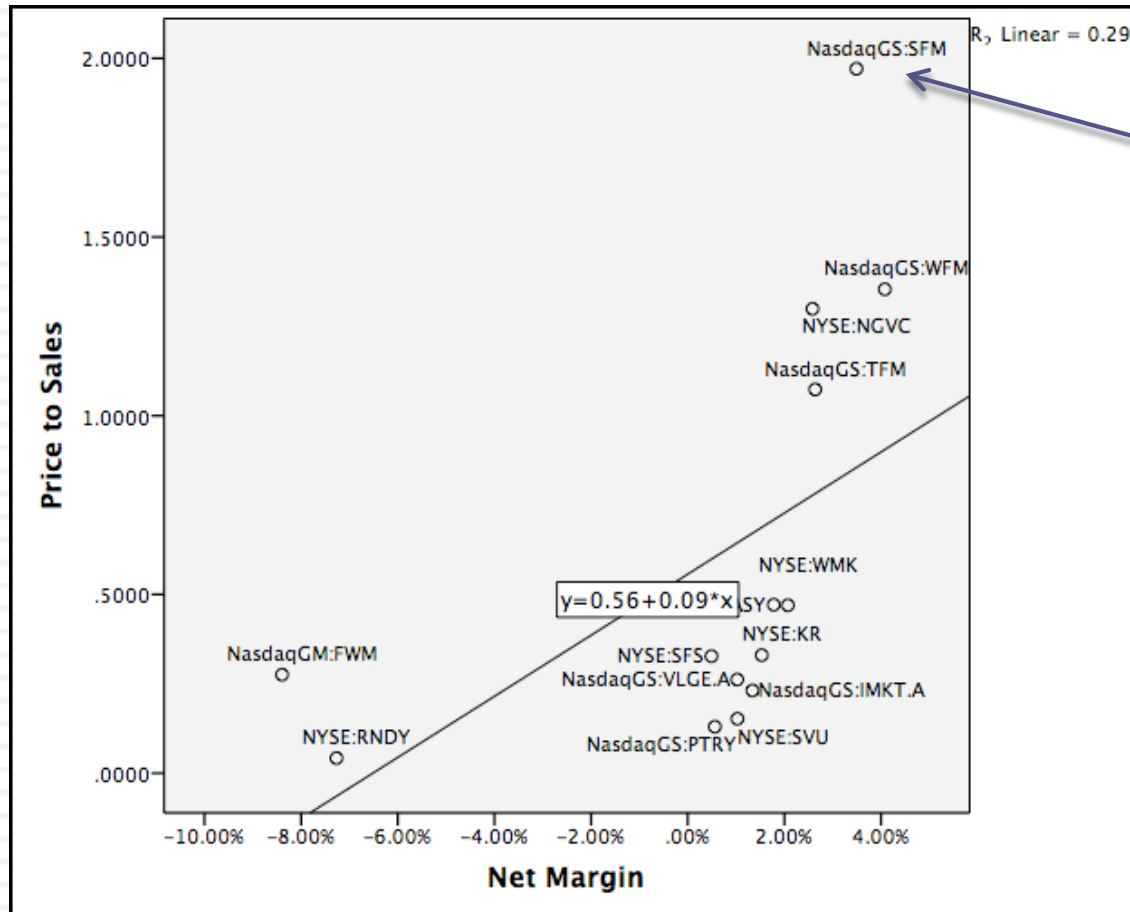


Whole Foods: In 2010, Net Margin had dropped to 1.44% and Price to Sales ratio increased to 0.50.

Predicted Price to Sales = $0.06 + 11.43 (.0144) = 0.22$

There is a new kid in town: January 2015

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There is a new star in town (Sprouts)

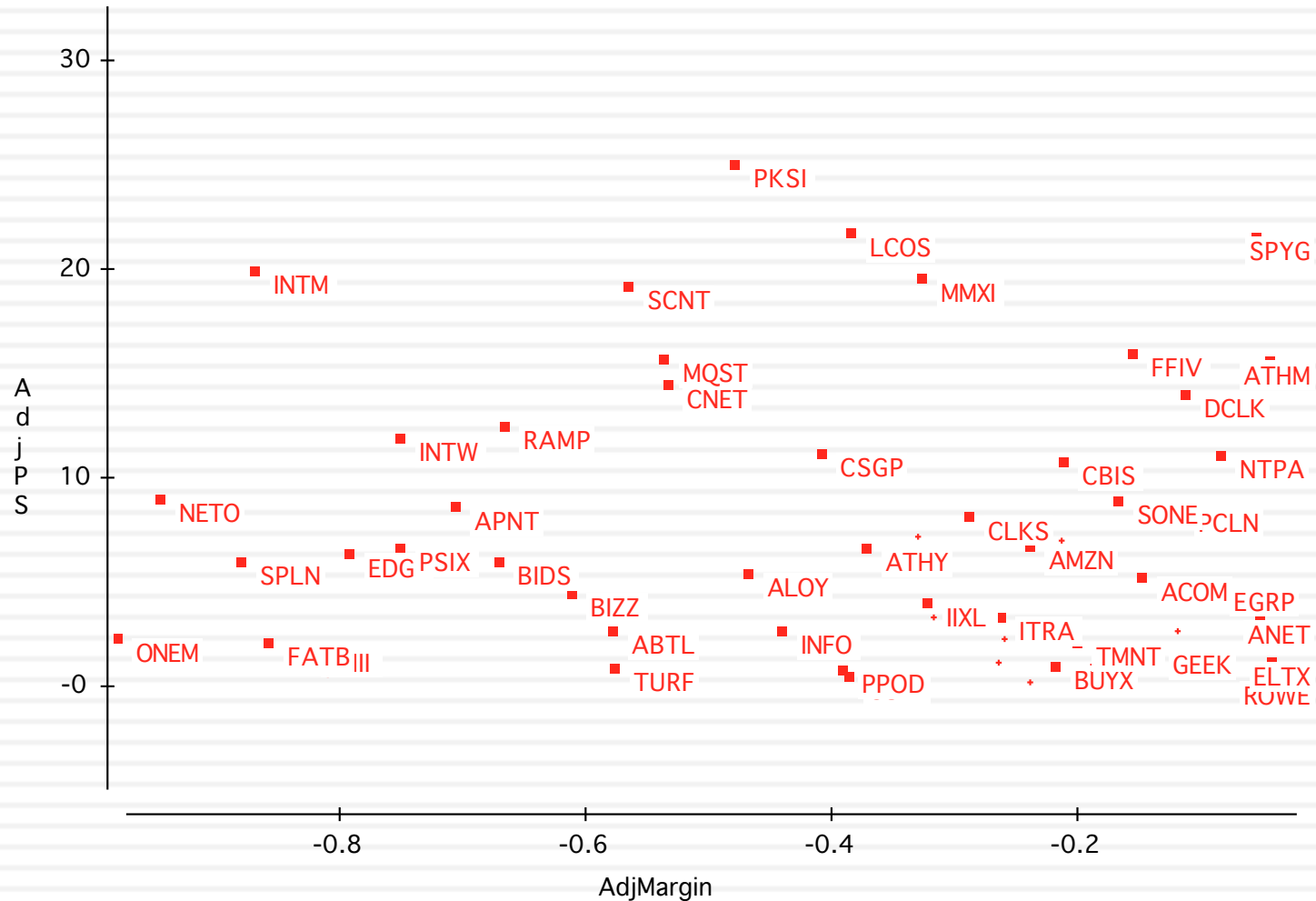
$$PS = 0.557 + 0.085 \text{ Net Margin}$$

$$\text{Whole Foods} = 0.557 + 8.50 (0.0408) = 0.90$$

At 1.35 times sales, Whole Foods is overvalued (again)

Example 7: Nothing's working! Internet Stocks in early 2000..

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PS Ratios and Margins are not highly correlated

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- Regressing PS ratios against current margins yields the following

$$\text{PS} = 81.36 - 7.54(\text{Net Margin}) \quad R^2 = 0.04$$

(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

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- 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)

$$\text{PS} = 30.61 - 2.77 \ln(\text{Rev}) + 6.42 (\text{Rev Growth}) + 5.11 (\text{Cash/Rev})$$

(0.66) (2.63) (3.49)

R squared = 31.8%

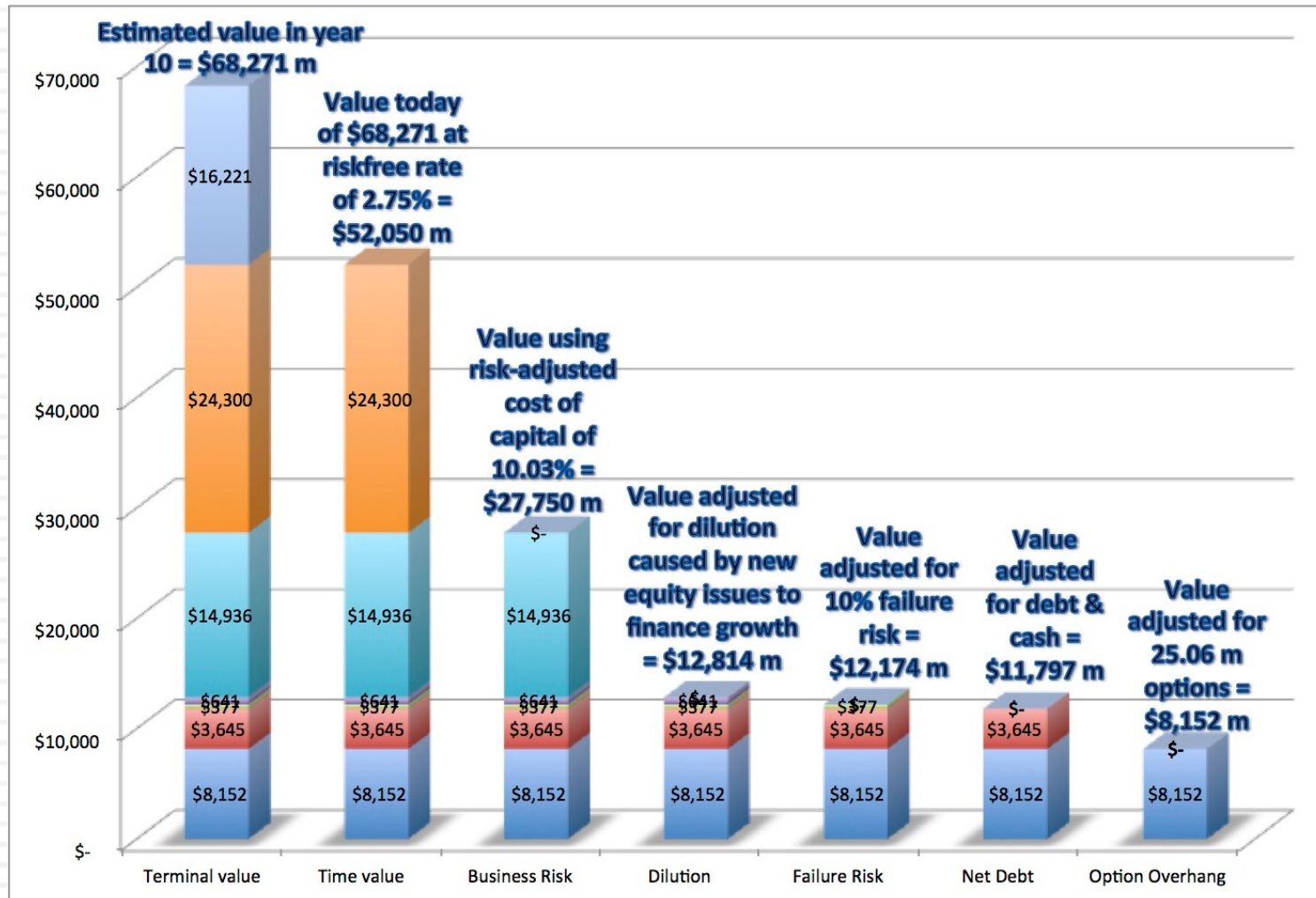
- Predicted PS = $30.61 - 2.77(7.1039) + 6.42(1.9946) + 5.11(.3069) = 30.42$
- Actual PS = 25.63

Stock is undervalued, relative to other internet stocks.

Solution 2: Use forward multiples

Watch out for bumps in the road (Tesla in 2013)

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The Market sets the rules...

- While we can compute multiples based upon accounting numbers (revenues, earnings, EBITDA or book value), you can also compute the multiple that market are paying on any quantifiable variable.
 - ▣ You can compute market cap or EV per employee, per subscriber, per customer etc.
 - ▣ The question of whether you should do so is not a theoretical one. It is set by the market.
- Ultimately, your job in pricing is to figure what the market cares about when pricing companies and replicate it.

An Example: Let the market tell you what matters.. Social media in October 2013

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<i>Company</i>	<i>Market Cap</i>	<i>Enterprise value</i>	<i>Revenues</i>	<i>EBITDA</i>	<i>Net Income</i>	<i>Number of users (millions)</i>	<i>EV/User</i>	<i>EV/Revenue</i>	<i>EV/EBITDA</i>	<i>PE</i>
Facebook	\$173,540.00	\$160,090.00	\$7,870.00	\$3,930.00	\$1,490.00	1230.00	\$130.15	20.34	40.74	116.47
Linkedin	\$23,530.00	\$19,980.00	\$1,530.00	\$182.00	\$27.00	277.00	\$72.13	13.06	109.78	871.48
Pandora	\$7,320.00	\$7,150.00	\$655.00	-\$18.00	-\$29.00	73.40	\$97.41	10.92	NA	NA
Groupon	\$6,690.00	\$5,880.00	\$2,440.00	\$125.00	-\$95.00	43.00	\$136.74	2.41	47.04	NA
Netflix	\$25,900.00	\$25,380.00	\$4,370.00	\$277.00	\$112.00	44.00	\$576.82	5.81	91.62	231.25
Yelp	\$6,200.00	\$5,790.00	\$233.00	\$2.40	-\$10.00	120.00	\$48.25	24.85	2412.50	NA
Open Table	\$1,720.00	\$1,500.00	\$190.00	\$63.00	\$33.00	14.00	\$107.14	7.89	23.81	52.12
Zynga	\$4,200.00	\$2,930.00	\$873.00	\$74.00	-\$37.00	27.00	\$108.52	3.36	39.59	NA
Zillow	\$3,070.00	\$2,860.00	\$197.00	-\$13.00	-\$12.45	34.50	\$82.90	14.52	NA	NA
Trulia	\$1,140.00	\$1,120.00	\$144.00	-\$6.00	-\$18.00	54.40	\$20.59	7.78	NA	NA
Tripadvisor	\$13,510.00	\$12,860.00	\$945.00	\$311.00	\$205.00	260.00	\$49.46	13.61	41.35	65.90
						Average	\$130.01	11.32	350.80	267.44
						Median	\$97.41	10.92	44.20	116.47

Read the tea leaves: See what the market cares about

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	<i>Market Cap</i>	<i>Enterprise value</i>	<i>Revenues</i>	<i>EBITDA</i>	<i>Net Income</i>	<i>Number of users (millions)</i>
<i>Market Cap</i>	1.					
<i>Enterprise value</i>	0.9998	1.				
<i>Revenues</i>	0.8933	0.8966	1.			
<i>EBITDA</i>	0.9709	0.9701	0.8869	1.		
<i>Net Income</i>	0.8978	0.8971	0.8466	0.9716	1.	
<i>Number of users (millions)</i>	0.9812	0.9789	0.8053	0.9354	0.8453	1.

Twitter had 240 million users at the time of its IPO. What price would you attach to the company?

Pricing across the entire market: Why not?

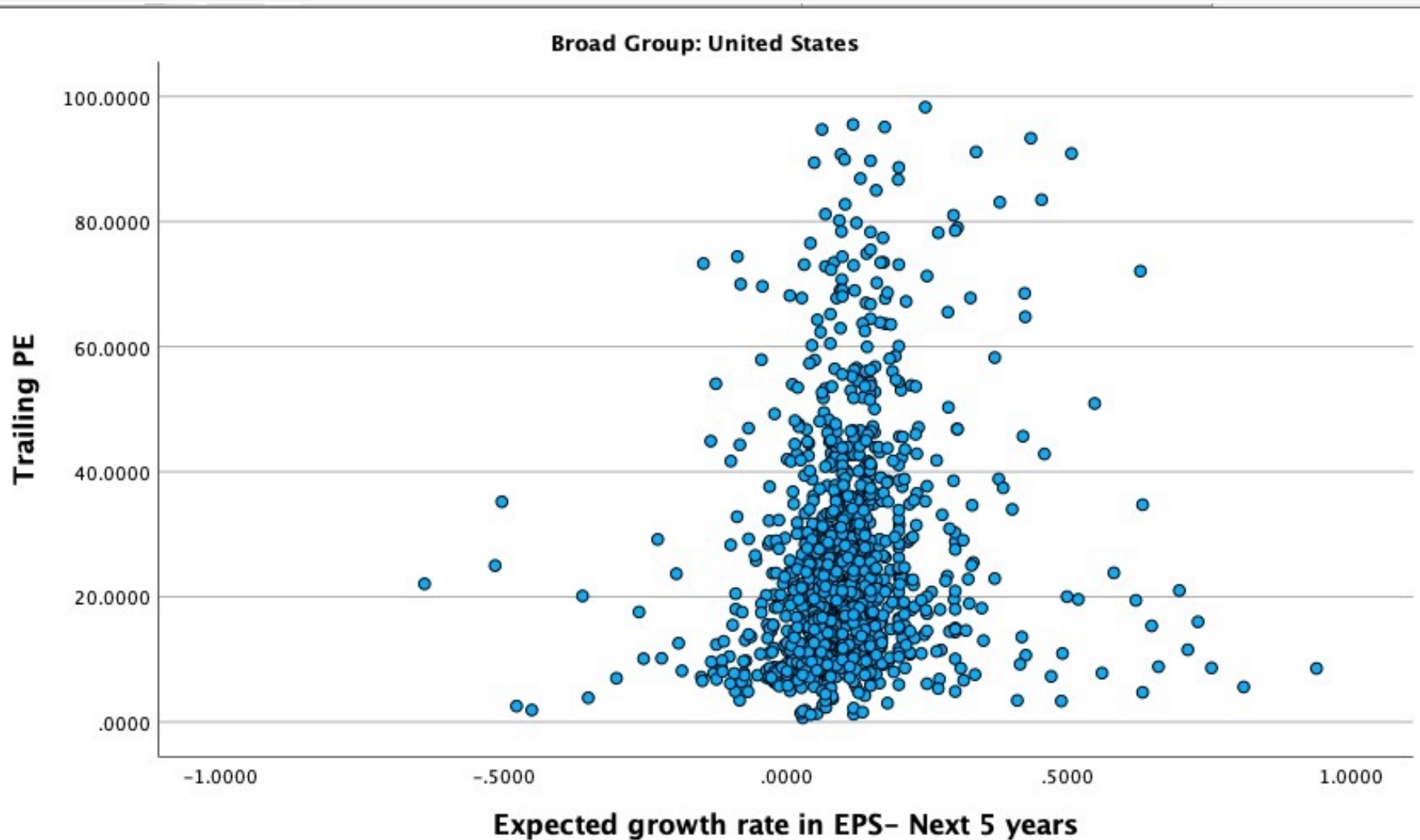
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- In contrast to the 'comparable firm' approach, the information in the entire cross-section of firms can be used to predict PE ratios.
- The simplest way of summarizing this information is with a multiple regression, with the PE ratio as the dependent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

PE Ratio versus the market

PE versus Expected EPS Growth: January 2024

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PE Ratio: Standard Regression for US stocks - January 2024

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Model Summary^a

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.580 ^b	.336	.334	3090.43701

a. Broad Group = United States

b. Predictors: (Constant), Expected growth rate in EPS- Next 5 years, Payout ratio, Beta

The regression is run with growth and payout entered as decimals, i.e., 25% is entered as 0.25)

Coefficients^{a,b,c}

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.109	1.885		-1.119	.264
	Beta	20.755	1.501	.399	13.831	<.001
	Payout ratio	11.378	1.447	.222	7.865	<.001
	Expected growth rate in EPS- Next 5 years	69.566	5.125	.377	13.574	<.001

a. Broad Group = United States

b. Dependent Variable: Trailing PE

c. Weighted Least Squares Regression - Weighted by Market Cap (in US \$)

Problems with the regression methodology

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- Non-linearity: The basic regression assumes a linear relationship between PE ratios and the financial proxies, and that might not be appropriate.
- Non-stationarity: The basic relationship between PE ratios and financial variables itself might not be stable, and if it shifts from year to year, the predictions from the model may not be reliable. For instance, the 2022 regression has a markedly lower R-squared than the regressions in prior years, as the COVID effect on earnings plays out.
- Multi-collinearity: The independent variables are correlated with each other. For example, high growth firms tend to have high risk. This multi-collinearity makes the coefficients of the regressions unreliable and may explain the large changes in these coefficients from period to period.

Statistically insignificant?

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- If a coefficient in a regression is statistically insignificant, all it is doing is adding noise to the regression prediction.
 - ▣ There are simple statistical tests of significance, such as the t statistics (>2 is very good, $1-2$ is marginal, <1 is noise)
 - ▣ With small samples, don't overload the regression with independent variables.
- Take the variable out of the regression, even if the fundamentals say it should matter. In pricing, it is the market that determines what matters.

The Negative Intercept Problem

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- When the intercept in a multiple regression is negative, there is the possibility that forecasted values can be negative as well.
- One way (albeit imperfect) is to re-run the regression without an intercept. When the intercept in a multiple regression is negative, there is the possibility that forecasted values can be negative as well. One way (albeit imperfect) is to re-run the regression without an intercept.

		Coefficients ^{a,b,c,d}				
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Beta	19.344	.814	.575	23.776	<.001
	Payout ratio	10.368	1.131	.135	9.170	<.001
	Expected growth rate in EPS- Next 5 years	68.704	5.067	.301	13.558	<.001

a. Broad Group = United States
b. Dependent Variable: Trailing PE
c. Linear Regression through the Origin
d. Weighted Least Squares Regression - Weighted by Market Cap (in US \$)

If a coefficient has the wrong sign: The Multicollinearity Problem

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Correlations^a

		Trailing PE	Beta	Payout ratio	Expected growth rate in EPS- Next 5 years
Trailing PE	Pearson Correlation	1	.116**	.167**	.091**
	Sig. (2-tailed)		<.001	<.001	.002
	N	2607	2481	2586	1114
Beta	Pearson Correlation	.116**	1	-.005	.140**
	Sig. (2-tailed)	<.001		.797	<.001
	N	2481	5634	2589	1444
Payout ratio	Pearson Correlation	.167**	-.005	1	-.154**
	Sig. (2-tailed)	<.001	.797		<.001
	N	2586	2589	2728	1157
Expected growth rate in EPS- Next 5 years	Pearson Correlation	.091**	.140**	-.154**	1
	Sig. (2-tailed)	.002	<.001	<.001	
	N	1114	1444	1157	1462

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

a. Broad Group = United States

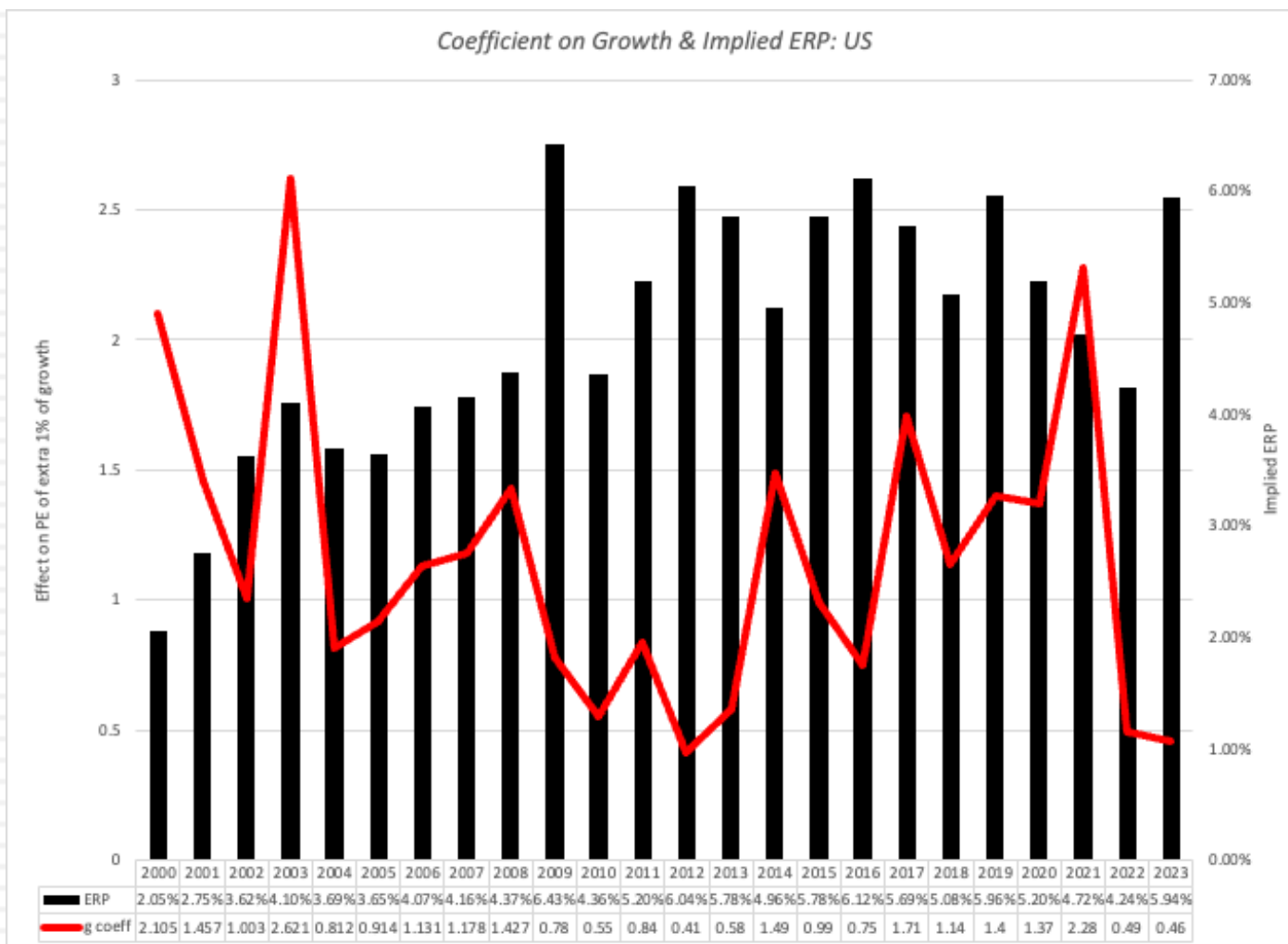
Using the PE ratio regression

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- Assume that you were given the following information for Disney. The firm has an expected growth rate of 15%, a beta of 0.90 and a 20% dividend payout ratio. Based upon the regression, the predicted PE ratio for Disney is:
 - ▣ Predicted PE = $19.34 (0.9) + 10.37 (.20) + 68.70 (.15) = 29.8$
- Disney is trading at 74.7 times earnings. What does the predicted PE tell you?

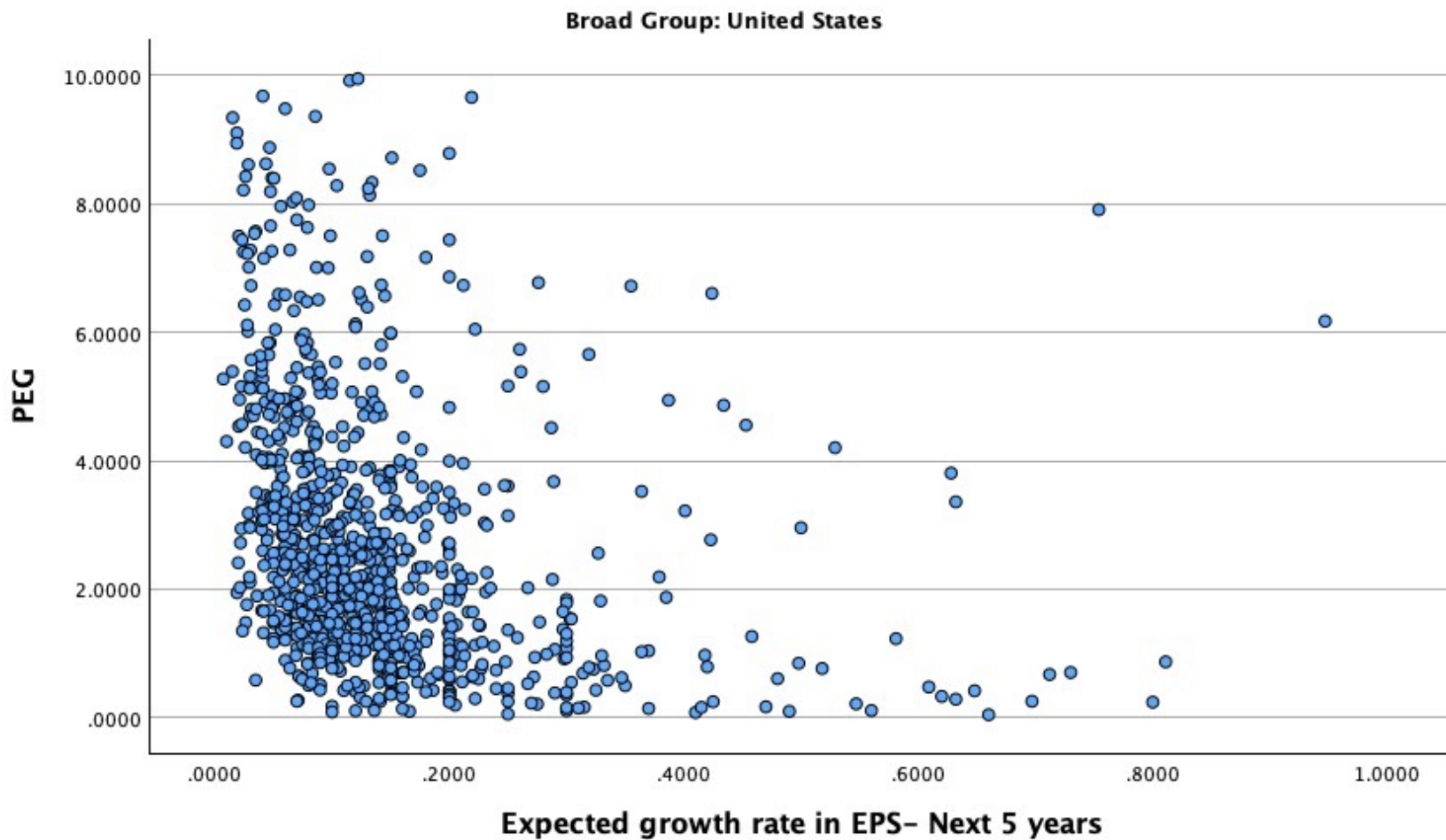
- Assume now that you priced Disney against just its peer group. Will you come to the same pricing judgment as you did when you looked at it relative to the market? Why or why not?

The value of growth



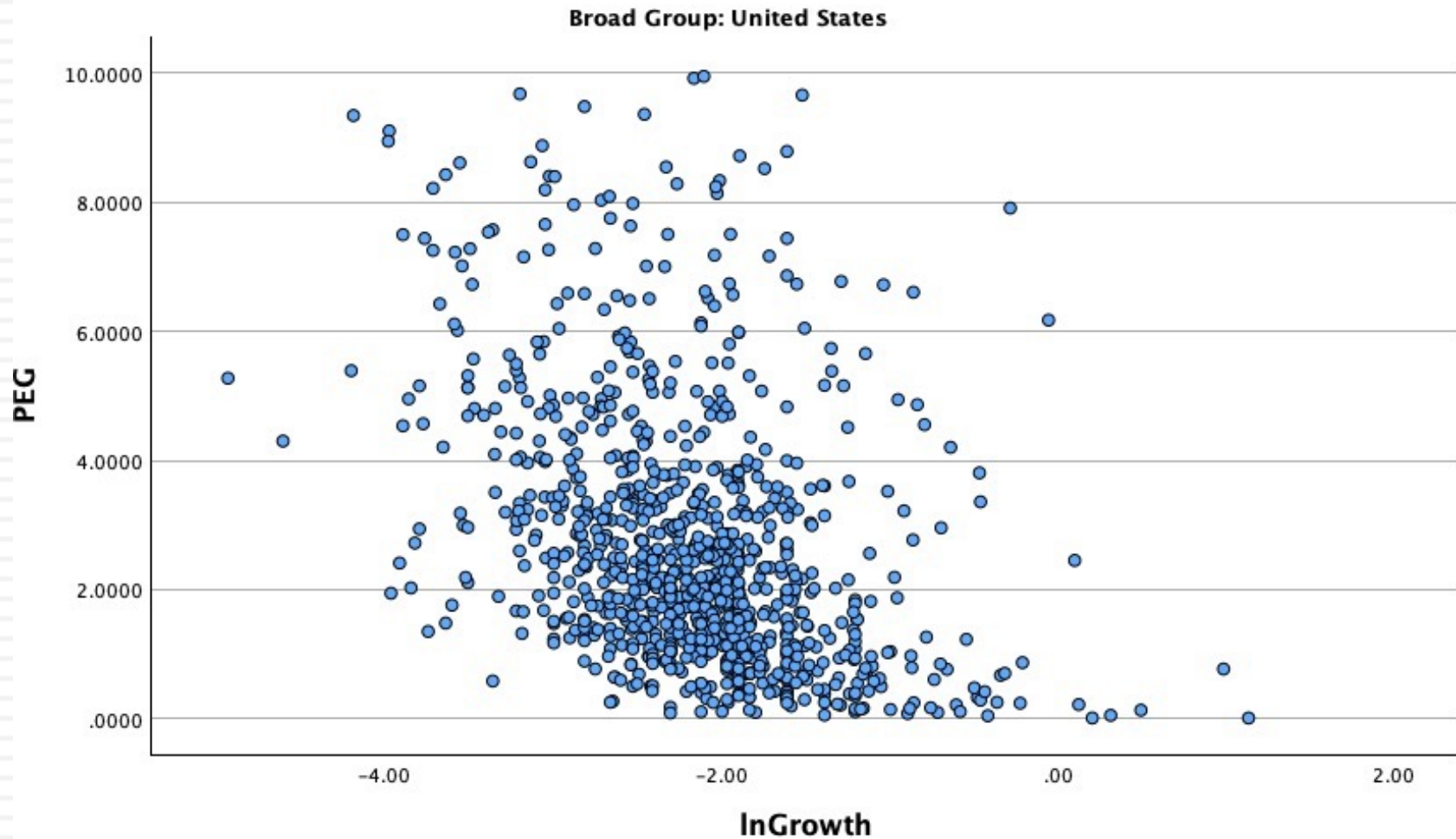
II. PEG Ratio versus the market PEG versus Growth

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PEG versus ln(Expected Growth)

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PEG Ratio Regression - US stocks

January 2024

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Model Summary^a

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.299 ^b	.089	.086	317.4781994

a. Broad Group = United States

b. Predictors: (Constant), InGrowth, Payout ratio, Beta

Coefficients^{a,b,c}

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.239	.333		.717	.474
	Beta	1.280	.163	.294	7.870	<.001
	Payout ratio	.865	.171	.184	5.044	<.001
	InGrowth	-.582	.103	-.202	-5.625	<.001

a. Broad Group = United States

b. Dependent Variable: PEG

c. Weighted Least Squares Regression - Weighted by Market Cap (in US \$)