

## Price Sales Ratio: Definition

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- The price/sales ratio is the ratio of the market value of equity to the sales.

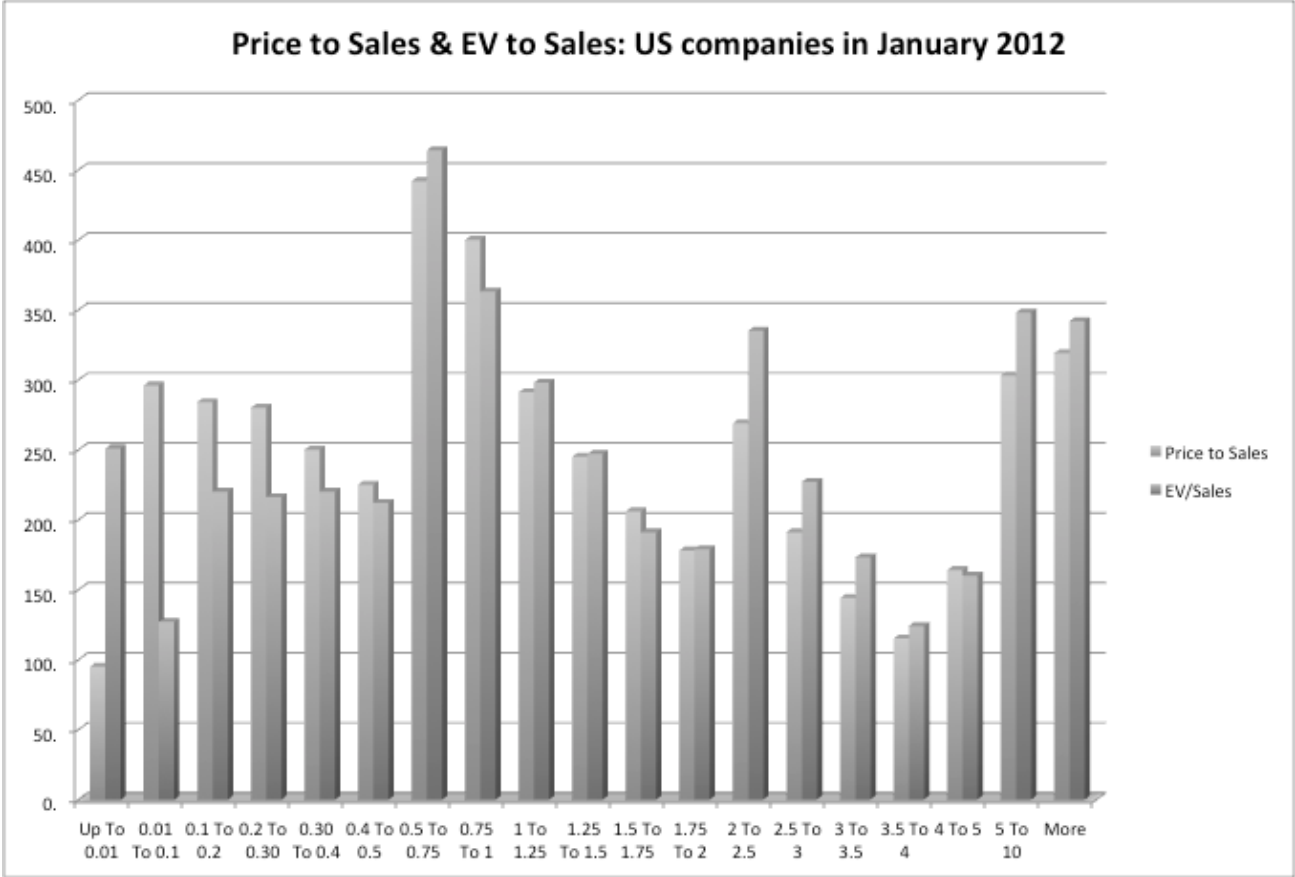
- Price/ Sales=

$$\frac{\text{Market value of equity}}{\text{Revenues}}$$

- Consistency Tests

- The price/sales ratio is internally inconsistent, since the market value of equity is divided by the total revenues of the firm.

# Revenue Multiples: US stocks



## Price/Sales Ratio: Determinants

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- 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:

$$\frac{P_0}{Sales_0} = PS = \frac{\text{Net Profit Margin} * \text{Payout Ratio} * (1 + g_n)}{r - g_n}$$

## Price/Sales Ratio for High Growth Firm

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- When the growth rate is assumed to be high for a future period, the dividend discount model can be written as follows:

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

- Dividing both sides by the sales per share:

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

where  $\text{Net Margin}_n = \text{Net Margin}$  in stable growth phase

## Price Sales Ratios and Profit Margins

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- The key determinant of price-sales ratios is the profit margin.
- A decline in profit margins has a two-fold effect.
  - First, the reduction in profit margins reduces the price-sales ratio directly.
  - Second, the lower profit margin can lead to lower growth and hence lower price-sales ratios.

$$\begin{aligned}\text{Expected growth rate} &= \text{Retention ratio} * \text{Return on Equity} \\ &= \text{Retention Ratio} * (\text{Net Profit} / \text{Sales}) * (\text{Sales} / \text{BV of Equity}) \\ &= \text{Retention Ratio} * \text{Profit Margin} * \text{Sales/BV of Equity}\end{aligned}$$

## Price/Sales Ratio: An Example

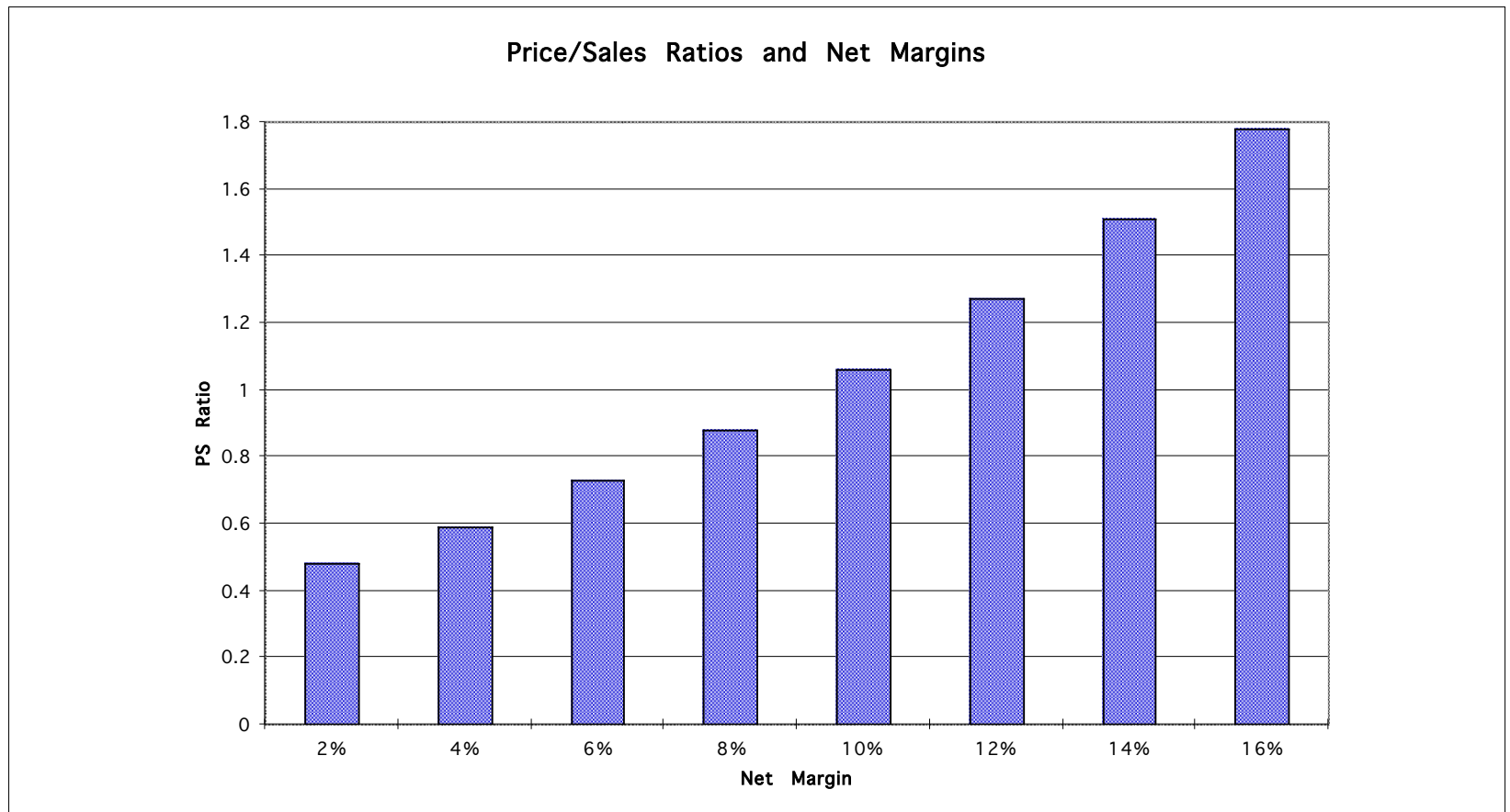
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	High Growth Phase	Stable Growth
Length of Period	5 years	Forever after year 5
Net Margin	10%	6%
Sales/BV of Equity	2.5	2.5
Beta	1.25	1.00
Payout Ratio	20%	60%
Expected Growth	(.1)(2.5)(.8)=20%	(.06)(2.5)(.4)=.06
Riskless Rate =6%		

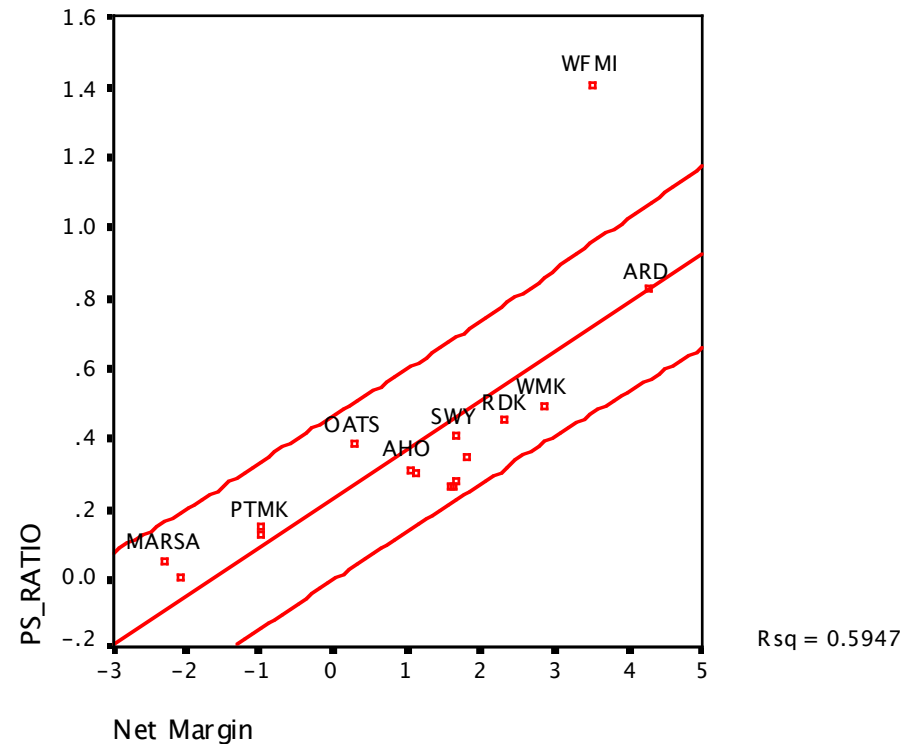
$$\text{PS} = \left[ \frac{0.10 * 0.2 * (1.20) * \left( 1 - \frac{(1.20)^5}{(1.12875)^5} \right)}{(.12875 - .20)} + \frac{0.06 * 0.60 * (1.20)^5 * (1.06)}{(.115 - .06) (1.12875)^5} \right] = 1.06$$

# Effect of Margin Changes

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# Price to Sales Multiples: Grocery Stores - US in January 2007

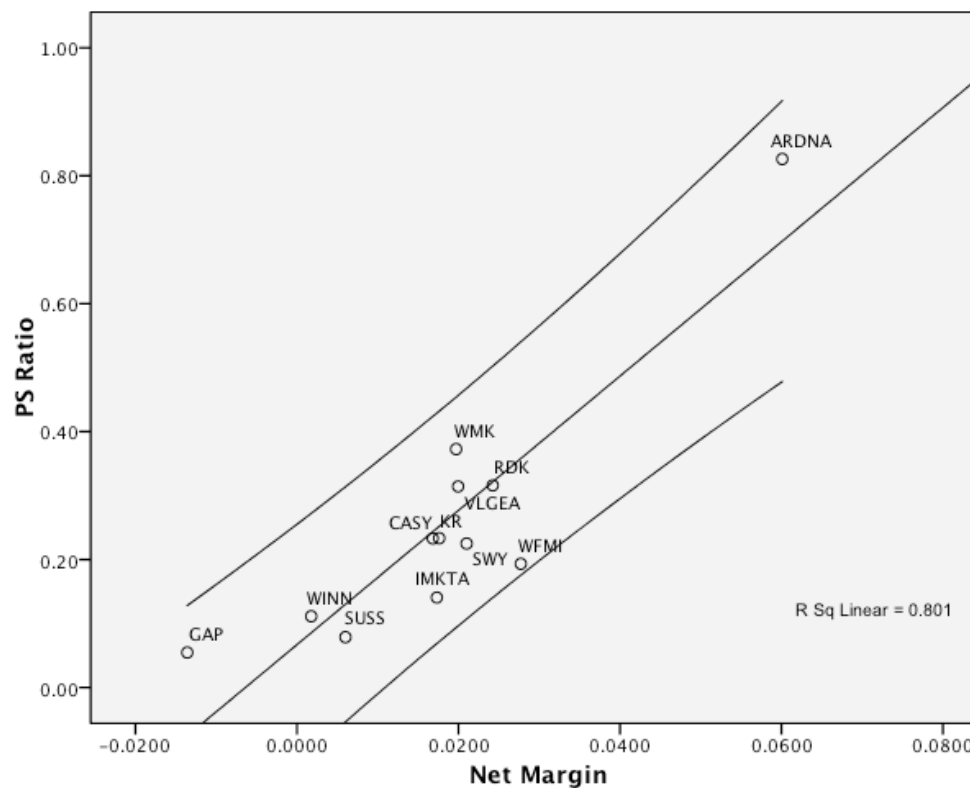


Whole Foods: In 2007: Net Margin was 3.41% and Price/ Sales ratio was 1.41  
Predicted Price to Sales =  $0.07 + 10.49 (0.0341) = 0.43$



## Reversion to normalcy: Grocery Stores - US in January 2009

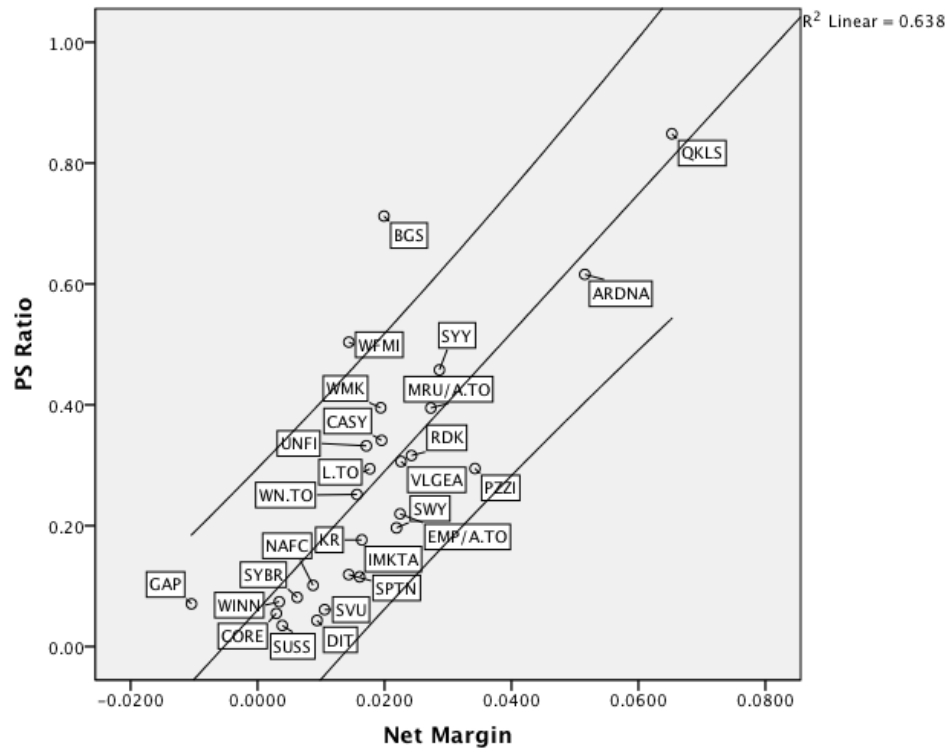
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Whole Foods: In 2009, Net Margin had dropped to 2.77% and Price to Sales ratio was down to 0.31.

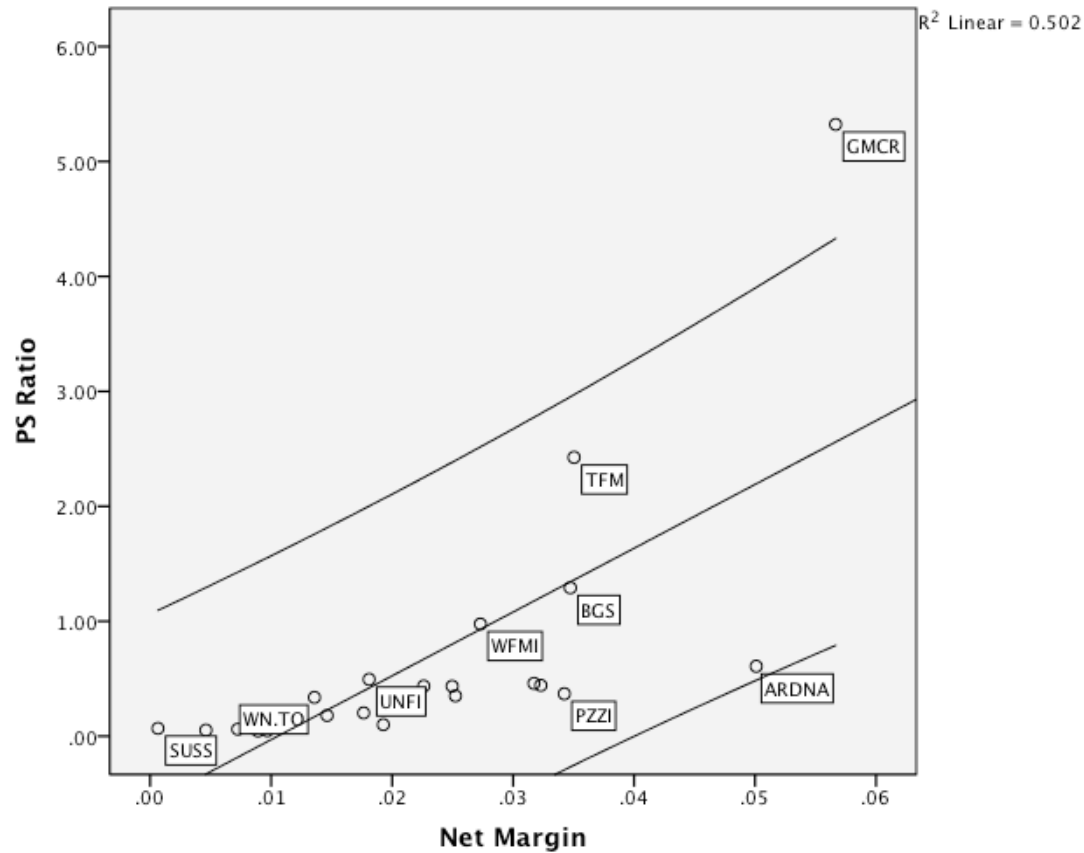
$$\text{Predicted Price to Sales} = 0.07 + 10.49 (.0277) = 0.36$$

## And again in 2010..



Whole Foods: In 2010, Net Margin had dropped to 1.44% and Price to Sales ratio increased to 0.50.  
 ————— Predicted Price to Sales =  $0.06 + 11.43 (.0144) = 0.22$

Here is 2011...



$$\text{PS Ratio} = -0.585 + 55.50 (\text{Net Margin}) \quad R^2 = 48.2\%$$

$$\text{PS Ratio for WFM} = -0.585 + 55.50 (.0273) = 0.93$$

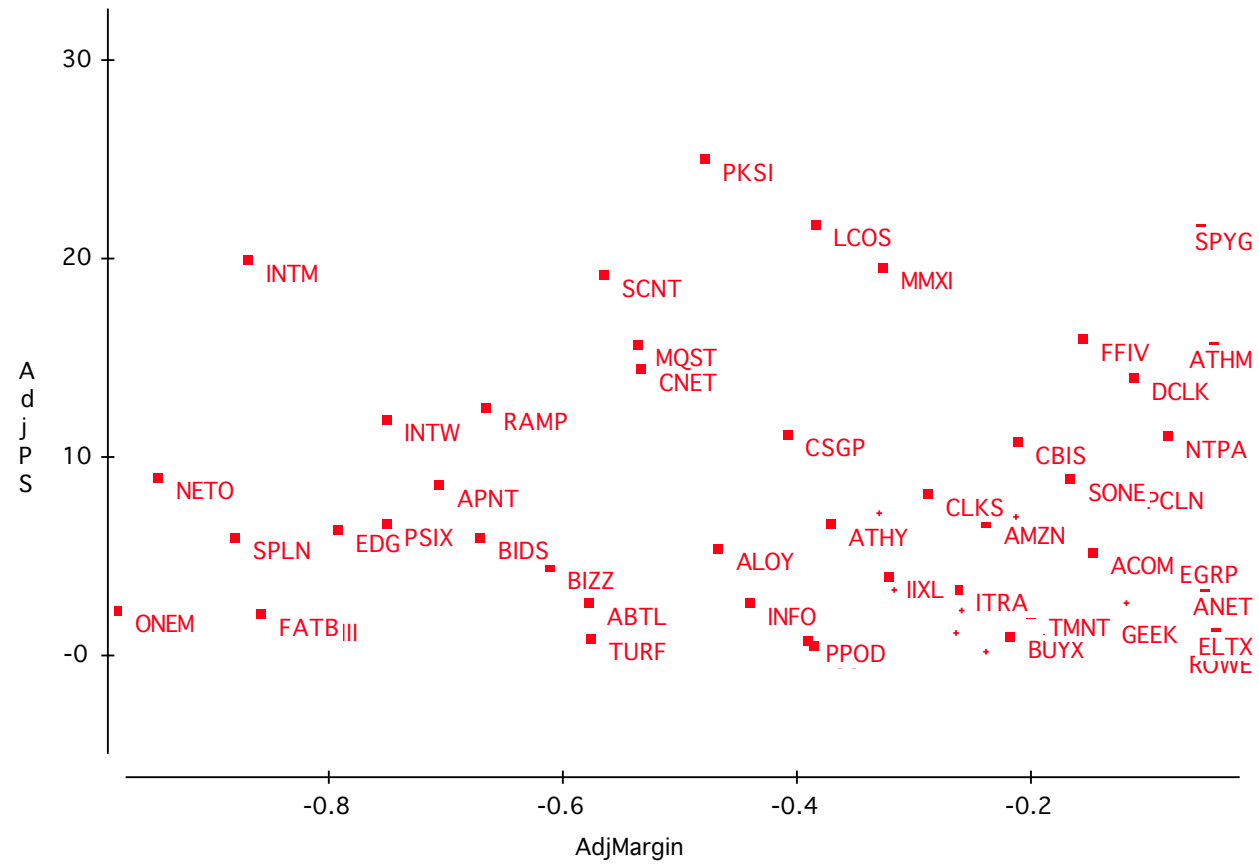
At a PS ratio of 0.98, WFM is slightly over valued.

## Current versus Predicted Margins

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- 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: Internet Stocks in January 2000



## 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. Consequently, there is little relationship between current margins and market values.

## 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

Amazon is undervalued, relative to other internet stocks.

## Solution 2: Use forward multiples

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- 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

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- Global Crossing, a distressed telecom firm, lost \$1.9 billion in 2001 and is expected to continue to lose money for the next 3 years. In a discounted cashflow 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 =  $\$ 9,871 \text{ million} / 1.138^5 = \$5,172$  million
- This enterprise value does not fully reflect the possibility that Global Crossing will not make it as a going concern.
  - Based on the price of traded bonds issued by Global Crossing, the probability that Global Crossing will not make it as a going concern is 77% and the distress sale value is only a \$ 1 billion (1/2 of book value of assets).
  - Adjusted Enterprise value =  $5172 * .23 + 1000 (.77) = 1,960$  million

## PS Regression: United States - January 2012

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**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.703 <sup>a</sup>	.494	.494	113.670012

a. Predictors: (Constant), Net Margin, Expected Growth in EPS: next 5 years, 3-yr Regression Beta

**Coefficients<sup>a,b</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.359	.083		4.324	.000
	Expected Growth in EPS: next 5 years	2.814	.286	.169	9.854	.000
	3-yr Regression Beta	-.218	.056	-.068	-3.912	.000
	Net Margin	12.938	.319	.685	40.575	.000

a. Dependent Variable: PS Ratio

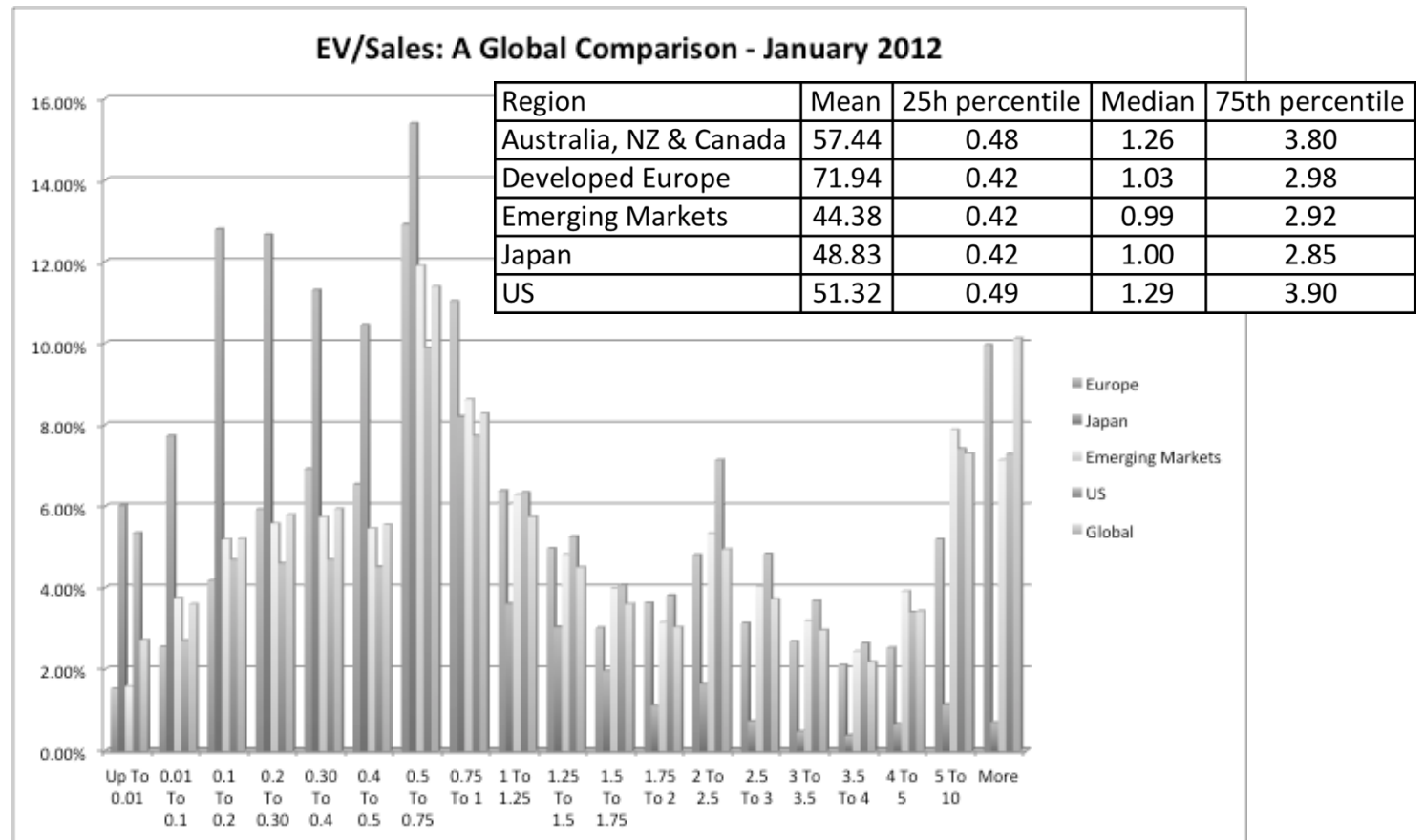
b. Weighted Least Squares Regression - Weighted by Market Cap

## EV/Sales Ratio: Definition

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- The value/sales ratio is the ratio of the market value of the firm to the sales.
- $EV/ Sales = \frac{\text{Market Value of Equity} + \text{Market Value of Debt-Cash}}{\text{Total Revenues}}$

# EV Sales across markets



## EV/Sales Ratios: Analysis of 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 assumption that
  - Free Cash Flow to the Firm = EBIT (1 - tax rate) (1 - Reinvestment Rate)
- Then the Value of the Firm can be written as a function of the after-tax operating margin = (EBIT (1-t)/Sales

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

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

$g_n$  = 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

## EV/Sales Ratio: An Example with Coca Cola

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- Consider, for example, the Value/Sales ratio of Coca Cola. The company had the following characteristics:

After-tax Operating Margin = 18.56%    Sales/BV of Capital = 1.67

Return on Capital = 1.67 \* 18.56% = 31.02%

Reinvestment Rate = 65.00% in high growth; 20% in stable growth;

Expected Growth = 31.02% \* 0.65 = 20.16%                      (Stable Growth Rate = 6%)

Length of High Growth Period = 10 years

Cost of Equity = 12.33%

E/(D+E) = 97.65%

After-tax Cost of Debt = 4.16%

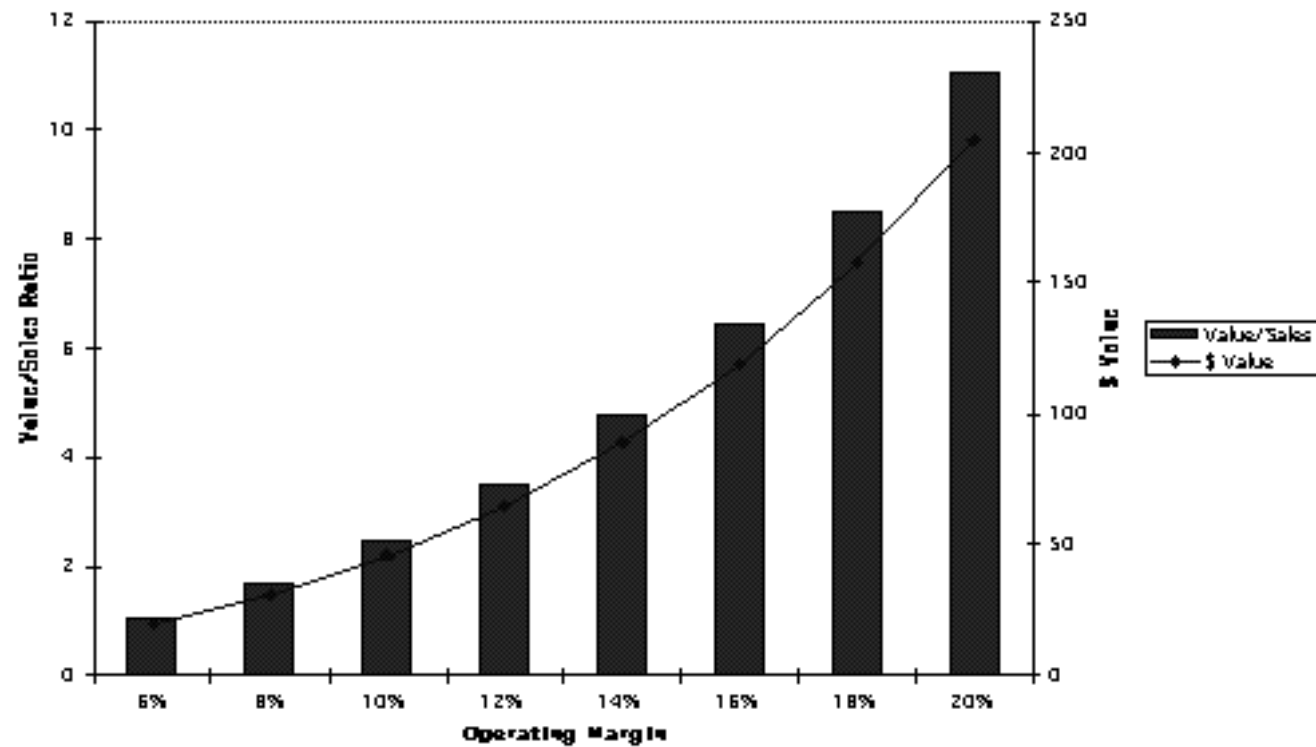
D/(D+E) = 2.35%

Cost of Capital = 12.33% (.9765) + 4.16% (.0235) = 12.13%

$$\frac{\text{Value of Firm}_0}{\text{Sales}_0} = .1856 * \left[ \frac{(1 - .65)(1.2016)^* \left( 1 - \frac{(1.2016)^{10}}{(1.1213)^{10}} \right)}{.1213 - .2016} + \frac{(1 - .20)(1.2016)^{10} * (1.06)}{(.1213 - .06)(1.1213)^{10}} \right] = 6.10$$

# EV/Sales Ratios and Operating Margins

**Coca Cola: The Operating Margin Effect**



## Brand Name Premiums in Valuation

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- You have been hired to value Coca Cola for an analyst reports and you have valued the firm at 6.10 times revenues, using the model described in the last few pages. Another analyst is arguing that there should be a premium added on to reflect the value of the brand name. Do you agree?
  - Yes
  - No
  - Explain.



## 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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	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%
<b>Value of Firm =</b>	<b>\$79,611.25</b>	<b>\$15,371.24</b>

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

## More on brand name value...

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- When we use the difference in margins to value brand name, we are assuming that the difference in margins is entirely due to brand name and that it affects nothing else (cost of capital, for instance) . To the extent that this is not the case, we may be under or over valuing brand name.
  - In which of these companies do you think valuing brand name will be easiest to do and which of them will it be hardest?
    - Kelloggs
    - Sony
    - Goldman Sachs
    - Apple
- Explain.

## EV/Sales Ratio Regression: US in January 2012

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**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.733 <sup>a</sup>	.537	.536	120.019400

a. Predictors: (Constant), Pre-tax Operating Margin, Eff Tax Rate, Expected Growth in Revenues: next 5 years, Market Debt to Capital

**Coefficients<sup>a,b</sup>**

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
1 (Constant)	.434	.133	3.249	.001
Expected Growth in Revenues: next 5 years	7.121	.682	.215	10.447
Market Debt to Capital	-.389	.212	-.038	-1.837
Eff Tax Rate	-1.871	.271	-.125	-6.906
Pre-tax Operating Margin	7.686	.217	.643	35.388

a. Dependent Variable: EV/Sales

b. Weighted Least Squares Regression - Weighted by Market Cap

## EV/Sales Regressions across markets...

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<b>Region</b>	<b>Regression – January 2011</b>	<b>R Squared</b>
Europe	EV/Sales = 2.28 - 0.01 Interest Coverage Ratio + 6.47 Operating Margin - 3.70 Tax Rate - 0.67 Reinvestment Rate	49.8%
Japan	EV/Sales = 1.01 + 5.31 Operating Margin	18.9%
Emerging Markets	EV/Sales = 1.67 - 2.70 Tax rate + 8.25 Operating Margin - 0.002 Interest Coverage Ratio - 0.29 Reinvestment Rate	31.7%