

CHAPTER 20

REVENUE MULTIPLES AND SECTOR-SPECIFIC MULTIPLES

While earnings and book value multiples are intuitively appealing and widely used, analysts in recent years have increasingly turned to alternative multiples to value companies. For new economy firms that have negative earnings, multiples of revenues have replaced multiples of earnings in many valuations. In addition, these firms are being valued on multiples of sector-specific measures such as the number of customers, subscribers or even web-site visitors. In this chapter, the reasons for the increased use of revenue multiples are examined first, followed by an analysis of the determinants of these multiples and how best to use them in valuation. This is followed by a short discussion of the sector specific multiples, the dangers associated with their use and the adjustments that might be needed to make them work.

Revenue Multiples

A revenue multiple measures the value of the equity or a business relative to the revenues that it generates. As with other multiples, other things remaining equal, firms that trade at low multiples of revenues are viewed as cheap relative to firms that trade at high multiples of revenues.

Revenue multiples have proved attractive to analysts for a number of reasons. First, unlike earnings and book value ratios, which can become negative for many firms and thus not meaningful, revenue multiples are available even for the most troubled firms and for very young firms. Thus, the potential for bias created by eliminating firms in the sample is far lower. Second, unlike earnings and book value, which are heavily influenced by accounting decisions on depreciation, inventory, R&D, acquisition accounting and extraordinary charges, revenue is relatively difficult to manipulate. Third, revenue multiples are not as volatile as earnings multiples and hence are less likely to be affected by year-to-year swings in firm's fortune. For instance, the price-earnings ratio of a cyclical firm changes much more than its price-sales ratios, because earnings are much more sensitive to economic changes than revenues.

The biggest disadvantage of focusing on revenues is that it can lull you into assigning high values to firms that are generating high revenue growth while losing

significant amounts of money. Ultimately, a firm has to generate earnings and cash flows for it to have value. While it is tempting to use price-sales multiples to value firms with negative earnings and book value, the failure to control for differences across firms in costs and profit margins can lead to misleading valuations.

Definition of Revenue Multiple

As noted in the introduction to this section, there are two basic revenue multiples in use. The first, and more popular one, is the multiple of the market value of equity to the revenues of a firm – this is termed the price to sales ratio. The second, and more robust ratio, is the multiple of the value of the firm (including both debt and equity) to revenues – this is the enterprise value to sales ratio.

$$\text{Price to Sales Ratio} = \frac{\text{Market Value of Equity}}{\text{Revenues}}$$

$$\text{Enterprise Value to Sales Ratio} = \frac{\text{Market Value of Equity} + \text{Market Value of Debt} - \text{Cash}}{\text{Revenues}}$$

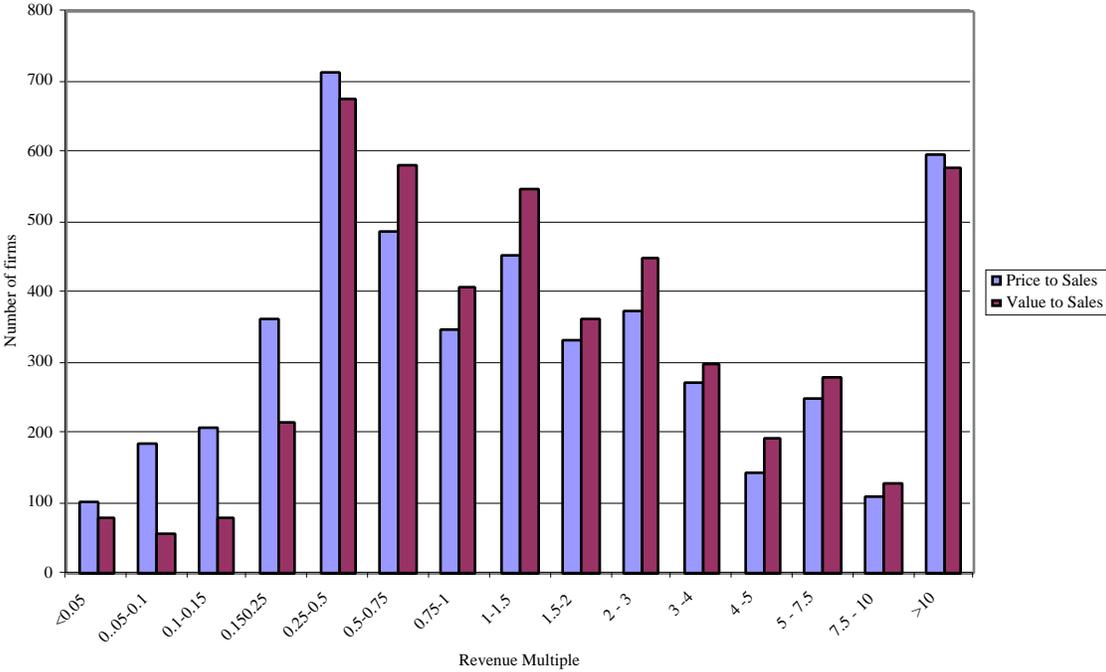
As with the EBITDA multiple, we net cash out of firm value, because the income from cash is not treated as part of revenue. The enterprise value to sales ratio a more robust multiple than the price to sales ratio because it is internally consistent. It divides the total value of the firm by the revenues generated by that firm. The price to sales ratio divides an equity value by revenues that are generated for the firm. Consequently, it will yield lower values for more highly levered firms and may lead to misleading conclusions when price to sales ratios are compared across firms in a sector with different degrees of leverage.

Accounting standards across different sectors and markets are fairly similar when it comes to how revenues are recorded. There have been firms, in recent years though, that have used questionable accounting practices in recording installment sales and intra-company transactions to make their revenues higher. Notwithstanding these problems, revenue multiples suffer far less than other multiples from differences across firms.

Cross Sectional Distribution

As with the price earning ratio, the place to begin the examination of revenue multiples is with the cross sectional distribution of price to sales and value to sales ratios across firms in the United States. Figure 20.1 summarizes this distribution.

Figure 20.1: Revenue Multiples



There are two things worth noting in this distribution. The first is that revenue multiples are even more skewed towards positive values than earnings multiples. The second is that the price to sales ratio is generally lower than the value to sales ratio, which should not be surprising since the former includes only equity while the latter considers firm value.

Table 20.1 provides summary statistics on both the price to sales and the value to sales ratios.

Table 20.1: Summary Statistics on Revenue Multiples: July 2000

	Price to Sales Ratio	Value to Sales Ratio
Number of firms	4940	4940
Average	13.22	13.89
Median	1.06	1.32

Standard Deviation	131.32	127.26
10 th percentile	0.15	0.27
90 th percentile	13.25	12.89

The average values for both multiples are much higher than the median values, largely as the result of outliers – there are firms that trade at multiples that exceed 100 or more. The price to sales ratio is slightly lower than the value to sales ratio but that is not surprising since the former uses only the value of equity in the numerator whereas the latter looks at firm value.



psdata.xls: There is a dataset on the web that summarizes price to sales and value to sales ratios and fundamentals by industry group in the United States for the most recent year.

Analysis of Revenue Multiples

The variables that determine the revenue multiples can be extracted by going back to the appropriate discounted cash flow models – dividend discount model (or a FCFE valuation model) for price to sales and a firm valuation model for value to sales ratios.

Price to Sales Ratios

The price to sales ratio for a stable firm can be extracted from a stable growth dividend discount model.

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

where,

P_0 = Value of equity

DPS_1 = Expected dividends per share next year

r = Required rate of return on equity

g_n = Growth rate in dividends (forever)

Substituting in for $DPS_1 = EPS_0 (1+g_n)$ (Payout ratio), the value of the equity can be written as:

$$P_0 = \frac{(\text{EPS}_0)(\text{Payout Ratio})(1 + g_n)}{r - g_n}$$

Defining the Net Profit Margin = $\frac{\text{EPS}_0}{\text{Sales per share}}$, the value of equity can be written as:

$$P_0 = \frac{(\text{Sales}_0)(\text{Net Margin})(\text{Payout Ratio})(1 + g_n)}{r - g_n}$$

Rewriting in terms of the Price/Sales ratio,

$$\frac{P_0}{\text{Sales}_0} = \text{PS} = \frac{(\text{Net Margin})(\text{Payout Ratio})(1 + g_n)}{r - g_n}$$

The PS ratio is an increasing function of the profit margin, the payout ratio and the growth rate and a decreasing function of the riskiness of the firm.

The price-sales 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. With two stages of growth, a high growth stage and a stable growth phase, the dividend discount model can be written as follows:

$$P_0 = \frac{(\text{EPS}_0)(\text{Payout Ratio})(1 + g)^n \left[1 - \frac{(1 + g)^n}{(1 + k_{e,hg})^n} \right]}{k_{e,hg} - g} + \frac{(\text{EPS}_0) * (\text{Payout Ratio}_n)(1 + g)^n (1 + g_n)}{(k_{e,st} - g_n)(1 + k_{e,hg})}$$

where,

g = Growth rate in the first n years

$k_{e,hg}$ = Cost of equity in high growth

Payout = Payout ratio in the first n years

g_n = Growth rate after n years forever (Stable growth rate)

$k_{e,hg}$ = Cost of equity in stable growth

Payout $_n$ = Payout ratio after n years for the stable firm

Rewriting EPS_0 in terms of the profit margin, $\text{EPS}_0 = (\text{Sales}_0) (\text{Profit Margin})$ and bringing Sales_0 to the left hand side of the equation, you get:

$$\frac{\text{Price}}{\text{Sales}} = (\text{Net Margin}) \frac{(\text{Payout Ratio})(1+g) \left[1 - \frac{(1+g)^n}{(1+k_{e,hg})^n} \right]}{k_{e,hg} - g} + \frac{(\text{Payout Ratio}_n)(1+g)^n (1+g_n)}{(k_{e,st} - g_n)(1+k_{e,hg})^n}$$

The left hand side of the equation is the price-sales ratio. It is determined by--

(a) *Net Profit Margin*: Net Income / Revenues. The price-sales ratio is an increasing function of the net profit margin. Firms with higher net margins, other things remaining equal, should trade at higher price to sales ratios.

(b) *Payout ratio during the high growth period and in the stable period*: The PS ratio increases as the payout ratio increases, for any given growth rate.

(c) *Riskiness (through the discount rate $k_{e,hg}$ in the high growth period and $k_{e,st}$ in the stable period)*: The PS ratio becomes lower as riskiness increases, since higher risk translates into a higher cost of equity.

(d) *Expected growth rate in Earnings, in both the high growth and stable phases*: The PS increases as the growth rate increases, in both the high growth and stable growth period.

You can apply this equation to estimate the price to sales ratio, even for a firm that is not paying dividends currently. As with the price to book ratio, you can substitute in the free cash flows to equity for the dividends in making this estimate. Doing so will yield a more reasonable estimate of the price to sales ratio for firms that pay out dividends that are far lower than what they can afford to pay out.

$$\frac{\text{Price}}{\text{Sales}} = (\text{Net Margin}) \frac{\frac{\text{FCFE}}{\text{Earnings}} (1+g) \left[1 - \frac{(1+g)^n}{(1+k_{e,hg})^n} \right]}{k_{e,hg} - g} + \frac{\frac{\text{FCFE}}{\text{Earnings}_n} (1+g)^n (1+g_n)}{(k_{e,st} - g_n)(1+k_{e,hg})^n}$$

Illustration 20.1: Estimating the PS ratio for a high growth firm in the two-stage model

Assume that you have been asked to estimate the PS ratio for a firm that is expected to be in high growth for the next 5 years. The following is a summary of the inputs for the valuation.

Growth rate in first five years = 25%

Payout ratio in first five years = 20%

Growth rate after five years = 8%

Payout ratio after five years = 50%

Beta = 1.0

Riskfree rate = T.Bond Rate = 6%

Net Profit Margin = 10%

Cost of Equity = 6% + 1(5.5%)= 11.5%

This firm’s price to sales ratio can be estimated as follows:

$$PS=0.10 \frac{(0.2)(1.25) \left[1 - \frac{(1.25)^5}{(1.115)^5} \right]}{0.115-0.25} + \frac{(0.50)(1.25)^5(1.08)}{(0.115-0.08)(1.115)^5} =2.87$$

Based upon this firm’s fundamentals, you would expect its equity to trade at 2.87 times revenues.

Illustration 20.2: Estimating the price to sales ratio for Unilever

Unilever is a U.K. based company that sells consumer products globally. To estimate the price to sales ratio for Unilever, we used the following inputs for the high growth and stable growth periods. The costs of equity and growth rates are estimated in British pounds. Table 20.2 summarizes the inputs used in the valuation.

Table 20.2: Inputs for Estimating Price to Sales: Unilever

	<i>High Growth Period</i>	<i>Stable Growth Period</i>
Length	5 years	Forever after year 5
Growth Rate	8.67%	5%
Net Profit Margin	5.82%	5.82%
Beta	1.10	1.10
Cost of Equity	10.5%	9.4%
Payout Ratio	51.17%	66.67%

The riskfree rate used in the analysis is 5% (long term British government bond rate) and the risk premium is 5% in the high growth period (due to Unilever’s exposure in emerging markets) and 4% in stable growth.

$$PS = (0.0582) \frac{(0.5117)(1.0867) \left[1 - \frac{(1.0867)^5}{(1.1050)^5} \right]}{0.1050 - 0.0867} + \frac{(0.6667)(1.0867)^5 (1.05)}{(0.094 - 0.05)(1.1050)^5} = 0.99$$

Based upon its fundamentals, you would expect Unilever to trade at 0.99 times revenues. The stock was trading at 1.15 times revenues in May 2001.

Value to Sales Ratio

To analyze the relationship between value and sales, consider the value of a stable growth firm:

$$\text{Firm Value}_0 = \frac{\text{EBIT}_1(1-t)(1 - \text{Reinvestment Rate})}{\text{Cost of Capital} - g_n}$$

Dividing both sides by the revenue, you get

$$\frac{\text{Firm Value}_0}{\text{Sales}} = \frac{(\text{EBIT}_1(1-t)/\text{Sales})(1 - \text{Reinvestment Rate})}{\text{Cost of Capital} - g_n}$$

$$\frac{\text{Firm Value}_0}{\text{Sales}} = \frac{(\text{After-tax Operating Margin})(1 - \text{Reinvestment Rate})}{\text{Cost of Capital} - g_n}$$

Just as the price to sales ratio is determined by net profit margins, payout ratios and costs of equity, the value to sales ratio is determined by after-tax operating margins, reinvestment rates and the cost of capital. Firms with higher operating margins, lower reinvestment rates (for any given growth rate) and lower costs of capital will trade at higher value to sales multiples.

This equation can be expanded to cover a firm in high growth by using a two-stage firm valuation model.

$$\frac{\text{Firm Value}_0}{\text{Sales}} = (\text{AT Oper Margin}) \frac{(1 - \text{RIR})(1 + g) \left[1 - \frac{(1 + g)^n}{(1 + k_{c,hg})^n} \right]}{k_{c,hg} - g} + \frac{(1 - \text{RIR}_n)(1 + g)^n (1 + g_n)}{(k_{c,st} - g_n)(1 + k_{c,hg})^n}$$

where

$$\text{AT Oper Margin} = \text{After-tax operating margin} = \frac{\text{EBIT}(1 - t)}{\text{Sales}}$$

RIR = Reinvestment Rate (RIR_n is for stable growth period)

k_c = Cost of capital (hg: high growth and st: stable growth periods)

g = Growth rate in operating income in high growth and stable growth periods

Note that the determinants of the value to sales ratio remain the same as they were in the stable growth model – the growth rate, the reinvestment rate, the operating margin and the cost of capital – but the number of estimates increases to reflect the existence of a high growth period.

Illustration 20.3: Estimating the value to sales ratio for Coca Cola

Coca Cola has one of the highest operating margins of any large U.S. firm and it should command a high value to sales ratio, as a consequence. To estimate the value to sales ratio at which Coca Cola should trade at, we used the following inputs.

Table 20.3: Inputs for Estimating Value to Sales: Coca Cola

	<i>High Growth Period</i>	<i>Stable Growth Period</i>
Length	10 years	Forever after year 10
Growth Rate	8.92%	5%
After-tax Operating Margin	16.31%	16.31%
Cost of Capital	9.71%	8.85%
Reinvestment Rate	40%	31.25%

The return on capital during the high growth period is expected to be 22.30% and to drop to 16% during stable growth. Based upon these inputs, we can estimate the value to sales ratio for Coca Cola.

$$VS = (0.1631) \frac{(1 - 0.40)(1.0892) \left[1 - \frac{(1.0892)^{10}}{(1.0971)^{10}} \right]}{0.0971 - 0.0892} + (0.1631) \frac{(1 - 0.3125)(1.0892)^{10}(1.05)}{(0.0885 - 0.05)(1.0971)^{10}} = 3.79$$

Based upon its fundamentals, you would expect Coca Cola to trade at 3.79 times revenues. The firm was trading at 5.9 times revenues in May 2001.

 *firmmult.xls*: This spreadsheet allows you to estimate the value to sales ratio for a stable growth or high growth firm, given its fundamentals.

Revenue Multiples and Profit Margins

The key determinant of revenue multiples is the profit margin – the net margin for price to sales ratios and operating margin for value to sales ratios. Firms involved in businesses that have high margins can expect to sell for high multiples of sales. However, a decline in profit margins has a two-fold effect. First, the reduction in profit margins reduces the revenue multiple directly. Second, the lower profit margin can lead to lower growth and hence lower revenue multiples.

The profit margin can be linked to expected growth fairly easily if an additional term is defined - the ratio of sales to book value, which is also called a turnover ratio. This turnover ratio can be defined in terms of book equity (Equity Turnover = Sales/ Book value of equity) or book capital (Capital Turnover = Sales/ Book value of capital). Using a relationship developed between growth rates and fundamentals, the expected growth rates in equity earnings and operating income can be written as a function of profit margins and turnover ratios.

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

For example, in the valuation of Unilever in Illustration 20.2, the expected growth rate of earnings is 8.67%. This growth rate can be derived from Unilever's net margin (5.82%) and sales/equity ratio (3.0485).

$$\begin{aligned}
 &= (\text{Retention ratio}) \frac{\text{Net Profit}}{\text{Sales}} \frac{\text{Sales}}{\text{BV of Equity}} \\
 \text{Expected Growth rate} &= (0.4883)(0.0582)(3.0485) \\
 &= 8.67\%
 \end{aligned}$$

For growth in operating income,

Expected growth_{Firm}

$$\begin{aligned}
&= (\text{Reinvestment Rate})(\text{Return on Capital}) \\
&= (\text{Reinvestment Rate}) \frac{\text{EBIT}(1-t)}{\text{Sales}} \frac{\text{Sales}}{\text{BV of Capital}} \\
&= (\text{Reinvestment Rate})(\text{After -tax Operating Margin})(\text{Sales/BV of Capital})
\end{aligned}$$

In the valuation of Coca Cola in Illustration 20.3, the expected growth rate of operating income is 8.92%. This growth rate can be derived from Coca Cola's after-tax operating margin (16.31%) and sales/capital ratio (1.37).

Expected growth_{firm}

$$\begin{aligned}
&= (\text{Reinvestment Rate})(\text{After - tax Operating Margin})(\text{Sales/BV of Capital}) \\
&= (0.4)(0.1631)(1.37) \\
&= 8.92\%
\end{aligned}$$

As the profit margin is reduced, the expected growth rate will decrease, if the sales do not increase proportionately.

Illustration 20.4: Estimating the effect of lower margins of price-sales ratios

Consider again the firm analyzed in Illustration 20.1. If the firm's profit margin declines and total revenue remains unchanged, the price/sales ratio for the firm will decline with it. For instance consider the effect if the firm's profit margin declines from 10% to 5%, and the sales/BV remains unchanged.

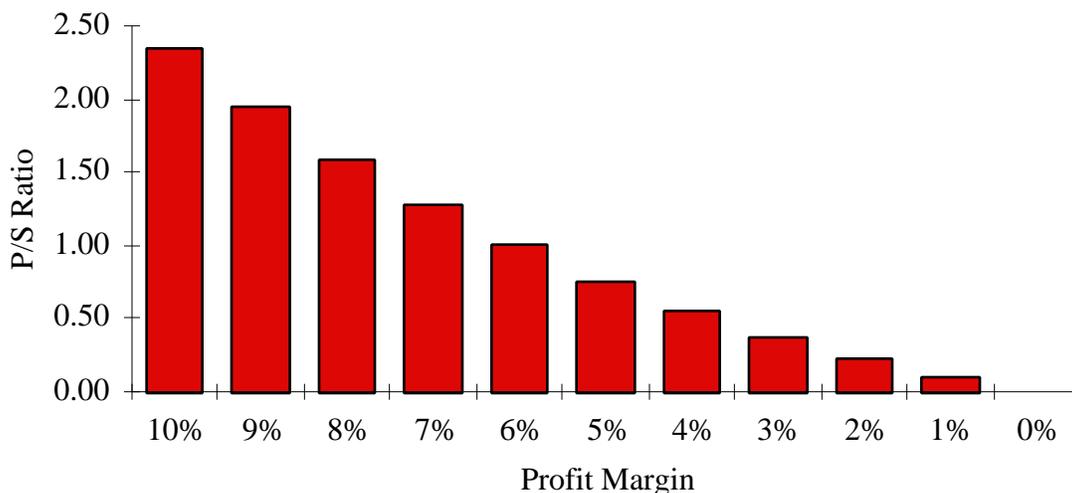
$$\begin{aligned}
&= (\text{Retention Ratio})(\text{Profit Margin})(\text{Sales/BV}) \\
\text{New Growth rate in first five years} &= (0.8)(0.05)(2.50) \\
&= 10\%
\end{aligned}$$

The new price sales ratio can then be calculated as follows:

$$\text{PS} = 0.05 \frac{(0.2)(1.10) \left[1 - \frac{(1.10)^5}{(1.115)^5} \right]}{0.115 - 0.10} + \frac{(0.50)(1.10)^5 (1.08)}{(0.115 - 0.08)(1.115)^5} = 0.77$$

The relationship between profit margins and the price-sales ratio is illustrated more comprehensively in the following graph. The price-sales ratio is estimated as a function of the profit margin, keeping the sales/book value of equity ratio fixed.

Figure 20.2: P/S Ratios and Profit Margins



This linkage of price-sales ratios and profit margins can be utilized to analyze the value effects of changes in corporate strategy as well as the value of a 'brand name'.

Marketing Strategy and Value

Every firm has a pricing strategy. At the risk of over-simplifying the choice, you can argue that firms have to decide whether they want to go with a low-price, high volume strategy (volume leader) or with a high price, lower volume strategy (price leader). In terms of the variables that link growth to value, this choice will determine the profit margin and turnover ratio to use in valuation.

You could analyze the alternative pricing strategies that are available to a firm by examining the impact that each strategy will have on margins and turnover and valuing the firm under each strategy. The strategy that yields the highest value for the firm is, in a sense, the optimal strategy.

Note that the effect of price changes on turnover ratios will depend in large part on how elastic or inelastic the demand for the firm's products are. Increases in the price of

a product will have a minimal effect on turnover ratios if demand is inelastic. In this case, the value of the firm will generally be higher with a price leader strategy. On the other hand, the turnover ratio could drop more than proportionately if the product price is increased and demand is elastic. In this case, firm value will increase with a volume leader strategy.

Illustration 20.5: Choosing between a high-margin and a low-margin strategy.

Assume that a firm has to choose between the two pricing strategies. In the first strategy, the firm will charge higher prices (resulting in higher net margins) and sell less (resulting in lower turnover ratios). In the second strategy, the firm will charge lower prices and sell more. Assume that the firm has done market testing and arrived at the following inputs:

	<i>High-Margin</i>	<i>Low-Margin</i>
	<i>Low Volume</i>	<i>High Volume</i>
Profit Margin	10%	5%
Sales/Book Value	2.5	4.0

Assume, in addition, that the firm is expected to pay out 20% of its earnings as dividends over the next five years, and 50% of earnings as dividends after that. The growth rate after year 5 is expected to be 8%. The book value of equity per share is \$10. The cost of equity for the firm is 11.5%.

High Margin Strategy

Expected Growth rate in first five years^{High margin}

$$\begin{aligned}
 &= (\text{Profit Margin})(\text{Sales/BV})(\text{Retention ratio}) \\
 &= (0.10)(2.5)(0.8) \\
 &= 20\%
 \end{aligned}$$

$$\begin{aligned}
 \text{Price/Sales Ratio High margin} &= (0.10) \frac{(0.2)(1.20) \left[1 - \frac{(1.20)^5}{(1.115)^5} \right]}{0.115 - 0.20} + \frac{(0.50)(1.20)^5 (1.08)}{(0.115 - 0.08)(1.115)^5} \\
 &= 2.35
 \end{aligned}$$

Sales/Book Value^{High margin} = 2.50

$$\text{Price High margin} = (\text{Price/Sales})(\text{Sales/BV})(\text{BV of Equity}) = (2.35)(2.5)(10) = \$ 58.83$$

Low Margin Strategy

Expected Growth rate in first five years Low margin

$$\begin{aligned} &= (\text{Profit Margin})(\text{Sales/BV})(\text{Retention ratio}) \\ &= (0.05)(4)(0.8) \\ &= 16\% \end{aligned}$$

Price/Sales Ratio $\text{Low margin} =$

$$= (0.05) \frac{(0.2)(1.16) \left[1 - \frac{(1.16)^5}{(1.115)^5} \right]}{0.115 - 0.16} + \frac{(0.50)(1.16)^5 (1.08)}{(0.115 - 0.08)(1.115)^5}$$

$$= 0.9966$$

Sales/Book Value $\text{Low margin} = 4.00$

$$\text{Price}_{\text{Low margin}} = (\text{Value/Sales})(\text{Sales/BV})(\text{BV of Equity}) = (0.9966)(4)(10) = \$39.86$$

The high margin strategy is clearly the better one to follow here, if the objective is value maximization.

Illustration 20.6: Examining the effects of moving to a lower-margin, higher volume strategy: Philip Morris in 1993

Philip Morris had sales of \$59,131 million, earned \$4,939 million in net income and had a book value of equity of \$12,563 million in 1992. The firm paid 42% of its earnings as dividends in 1992. The beta for the stock was 1.10.

Based upon 1992 figures, the inputs for the price/sales ratio calculation would be:

Profit Margin = 8.35%

Beta for the stock = 1.10

Sales / Book Value of Equity = 4.71

Expected Return = 7% + 1.1 (5.5%)

Book Value per share = \$14.10

= 13.05%

Retention Ratio = 58%

Expected growth rate over next five years

$$\begin{aligned} &= (\text{Retention Ratio})(\text{Profit Margin})(\text{Sales/Book Value}) \\ &= (0.58)(0.0835)(4.71) \\ &= 22.80\% \end{aligned}$$

Expected growth rate after five years = 6% Expected payout ratio after five years = 65%

Price/Sales Ratio 1992 Margins

$$= (0.0835) \frac{(0.42)(1.2280) \left[1 - \frac{(1.2280)^5}{(1.1305)^5} \right]}{0.1305 - 0.2280} + \frac{(0.65)(1.2280)^5 (1.06)}{(0.1305 - 0.06)(1.1305)^5}$$

$$= 1.46$$

Sales/Book Value 1992 Margins = 4.71

In April 1993, Philip Morris announced that it was cutting prices on its Marlboro Brand of cigarettes because of increasing competition from low-priced competitors. This was viewed by many analysts as a precursor of further price cuts and as a signal of a move to a lower-margin strategy. Assume that the profit margin will decline to 7% from 8.35%, as a consequence. If we assume that the sales/book value of equity ratio will remain unchanged at 4.71, we can estimate the expected growth.

Expected growth rate over next five years

$$\begin{aligned} &= (\text{Retention Ratio})(\text{Profit Margin})(\text{Sales/Book Value}) \\ &= (0.58)(0.07)(4.71) \\ &= 19.11\% \end{aligned}$$

Expected growth rate after five years = 6% Expected payout ratio after five years = 65%

Price/Sales Ratio 1992 Margins

$$= (0.07) \frac{(0.42)(1.1911) \left[1 - \frac{(1.1911)^5}{(1.1305)^5} \right]}{0.1305 - 0.1911} + \frac{(0.65)(1.1911)^5 (1.06)}{(0.1305 - 0.06)(1.1305)^5}$$

$$= 1.06$$

As a consequence of the new lower-price strategy, the price-sales ratio will decline from 1.46 to 1.06. Unless the sales/book value ratio increases by an equivalent proportion (16.19%), the value of Philip Morris will decrease. In the case where profit margins decline by this magnitude and the sales/book value is not expected to increase, the value will decline by 27.41%.

The market reacted negatively to the announcement of price cuts and the stock price dropped approximately 20% on the announcement.

Pricing Strategy, Market Share and Competitive Dynamics

All too often, firms analyze the effects of changing prices in a static setting, where only the firm is acting and the competition stays still. The problem, though, is that every action (especially when it comes to pricing) generates reactions from competition and the net effects can be unpredictable.

Consider, for instance, a firm that cuts prices, hoping to increase market share and sales. If the competition does nothing, the firm may be able to accomplish its objectives. If, on the other hand, the competition reacts by also cutting prices, the firm may find itself with lower margins and the same turnover ratios that it had before the price cut – a recipe for lower firm value. In competitive industries, you have to assume that the latter will happen and plan accordingly.

There are some firms that have focused on maximizing market share as their primary objective function. The linkage between increased market share and market value is a tenuous one and can be examined using the profit-margin/revenue multiple framework developed above. If increasing market share leads to higher margins, either because of economies of scale driving down costs or increased market power driving out competitors, it will lead to higher value. If the increase in the market share is accompanied by lower prices and profit margins, the net effect on value can be negative.

The Value of a Brand Name

One of the critiques of traditional valuation is that it fails to consider the value of brand names and other intangibles. Hiroyumi Itami, in his book "Mobilizing Invisible Assets", provides a summary of this criticism. He says:

"Analysts have tended to define assets too narrowly, identifying only those that can be measured, such as plant and equipment. Yet the intangible assets, such as a particular technology, accumulated consumer information, brand name, reputation and corporate culture, are invaluable to the firm's competitive power. In fact, these invisible assets are the only real source of competitive edge that can be sustained over time."

While this criticism is clearly overstated, the approaches used by analysts to value brand names are often ad-hoc and may significantly overstate or understate their value. Firms with well known brand names often sell for higher multiples than lesser-known firms. The standard practice of adding on a 'brand name premium', often set arbitrarily, in relationship to discounted cashflow value, can lead to erroneous estimates. Instead, the value of a brand name can be estimated using the approach that relates profit margins to price-sales ratios.

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:

$$\text{Value of brand name} = (V/S_b - V/S_g) \times (\text{Sales})$$

where,

$(V/S)_b$ = Value-Sales ratio of the firm with the benefit of the brand name

$(V/S)_g$ = Value-Sales ratio of the firm with the generic product

Illustration 20.7: Valuing a brand name using price-sales ratio

Consider two firms which produce similar products that compete in the same market place. Famous Inc. has a well-known brand name and has an after-tax operating profit margin of 10%, while NoFrills Inc. makes a generic version and has an after-tax operating margin of 5%. Both firms have the same sales-book capital ratio (2.50) and the cost of capital of 11.5%. In addition, both firms are expected to reinvest 80% of their operating income in the next five years and 50% of earnings after that. The growth rate after year 5 for both firms, is 8%.

*Valuing Famous*Expected growth rate_{Famous}

$$\begin{aligned}
&= (\text{Reinvestment Rate})(\text{After-tax Operating Margin})(\text{Sales/BV of Capital}) \\
&= (0.8)(0.10)(2.50) \\
&= 20\%
\end{aligned}$$

Value/Sales Ratio_{Famous}

$$=0.10 \frac{(0.2)(1.20) \left[1 - \frac{(1.20)^5}{(1.115)^5} \right]}{0.115-0.20} + \frac{(0.50)(1.20)^5(1.08)}{(0.115-0.08)(1.115)^5} = 2.35$$

*Valuing NoFrills*Expected growth rate_{NoFrills}

$$\begin{aligned}
&= (\text{Reinvestment Rate})(\text{After-tax Operating Margin})(\text{Sales/BV of Capital}) \\
&= (0.8)(0.05)(2.50) \\
&= 10\%
\end{aligned}$$

Value/Sales Ratio_{NoFrills}

$$=0.05 \frac{(0.2)(1.10) \left[1 - \frac{(1.10)^5}{(1.115)^5} \right]}{0.115-0.10} + \frac{(0.50)(1.10)^5(1.08)}{(0.115-0.08)(1.115)^5} = 0.77$$

Total Sales = \$ 2.5 billion

$$= (V/S_b - V/S_g)(\text{Sales})$$

Value of Brand Name = (2.35 - 0.77)(\$2.5 billion)

$$= \$3.96 \text{ billion}$$

Illustration 20.8: Valuing a brand name: The Coca Cola Example

In 2000, Coca Cola reported sales of \$20,458 million and after-tax operating income of \$3,337 million (thus yielding an after-tax operating margin of 16.31%). In

Illustration 20.3, we estimated a value to sales ratio of 3.79 for the company based upon these inputs. The equation for the value to sales ratio is reproduced.

$$VS = (0.1631) \frac{(1-0.40)(1.0892) \left[1 - \frac{(1.0892)^{10}}{(1.0971)^{10}} \right]}{0.0971 - 0.0892} + (0.1631) \frac{(1-0.3125)(1.0892)^{10}(1.05)}{(0.0885 - 0.05)(1.0971)^{10}} = 3.79$$

One reason for Coca Cola's high profit margin is its brand name. In contrast, Cott, a Canadian beverage manufacturer with a less well-known brand name, has an after-tax operating margin of 4.82% and a sales to capital ratio of 2.06. If Coca-Cola had earned this lower profit margin and matched this sales to capital ratio, the return on capital and expected growth rate during the high growth period would have been:

$$\begin{aligned} \text{Return on capital} &= (\text{After - tax Operating Margin})(\text{Sales/BV of capita}) \\ &= (0.0482)(2.06) \\ &= 9.92\% \end{aligned}$$

$$\begin{aligned} \text{Expected growth rate over next ten years} &= (\text{Reinvestment Rate})(\text{Return on capital}) \\ &= (0.40)(0.0992) \\ &= 3.97\% \end{aligned}$$

Assuming that this margin will be maintained in perpetuity, the reinvestment rate needed in stable growth will also increase to sustain a 5% growth rate:

$$\text{Reinvestment rate in stable growth} = \frac{g}{\text{ROC}} = \frac{0.05}{0.0992} = 50.42\%$$

With the lower growth rate during the high growth period and a higher reinvestment rate, we obtain a much lower value to sales ratio for Coca Cola.

$$VS = (0.0482) \frac{(1-0.40)(1.0397) \left[1 - \frac{(1.0397)^{10}}{(1.0971)^{10}} \right]}{0.0971 - 0.0397} + (0.0482) \frac{(1-0.3125)(1.0397)^{10}(1.05)}{(0.0885 - 0.05)(1.0971)^{10}} = 0.75$$

The value of the brand name for Coca Cola can be estimated now as the difference between these two valuations – one with Coca Cola's current margins and turnover ratios and one with generic margins and turnover ratios:

$$\begin{aligned}
 &= (\text{Value/Sales}_{2000 \text{ Margins}})(\text{Sales}_{\text{Coca Cola}}) \\
 \text{Value of Coca Cola} &= (3.79)(\$20,458) \\
 &= \$ 77,536 \text{ million} \\
 &= (\text{Value/Sales}_{\text{Generic}})(\text{Sales}_{\text{Coca Cola}}) \\
 \text{Value of Coca Cola as a generic firm} &= (0.75)(\$20,458) \\
 &= \$15,344 \text{ million} \\
 &= (\text{Value/Sales}_{2000 \text{ Margins}} - \text{Value/Sales}_{\text{Generic}})(\text{Sales}_{\text{Coca Cola}}) \\
 \text{Value of brand name} &= (3.79 - 0.75)(\$20,458 \text{ million}) \\
 &= \$ 62,192 \text{ million}
 \end{aligned}$$

Of Coca Cola's estimated value of \$77536 million, 80.21% stems from its brand name, which provides it with the market power to earn higher margins and to grow faster.

An aside on brand name value

It is common to see brand name premiums attached to discounted cash flow valuations. As you can see from the example above, this is a mistake. Done right, the value of a brand name is already built into the valuation in a number of places – higher operating margins, higher turnover ratios and, consequently, higher returns on capital. These, in turn, have ripple effects, increasing expected growth rates and value. Adding a brand name premium to this value would be double counting.

What about firms that do not exploit a valuable brand name? You might add a premium to the values of these firms, but the premium is not for the brand name but for control. In fact, you could estimate similar premiums for any underutilized or mismanaged assets, but you would pay the premiums only if you could acquire control of the firm.

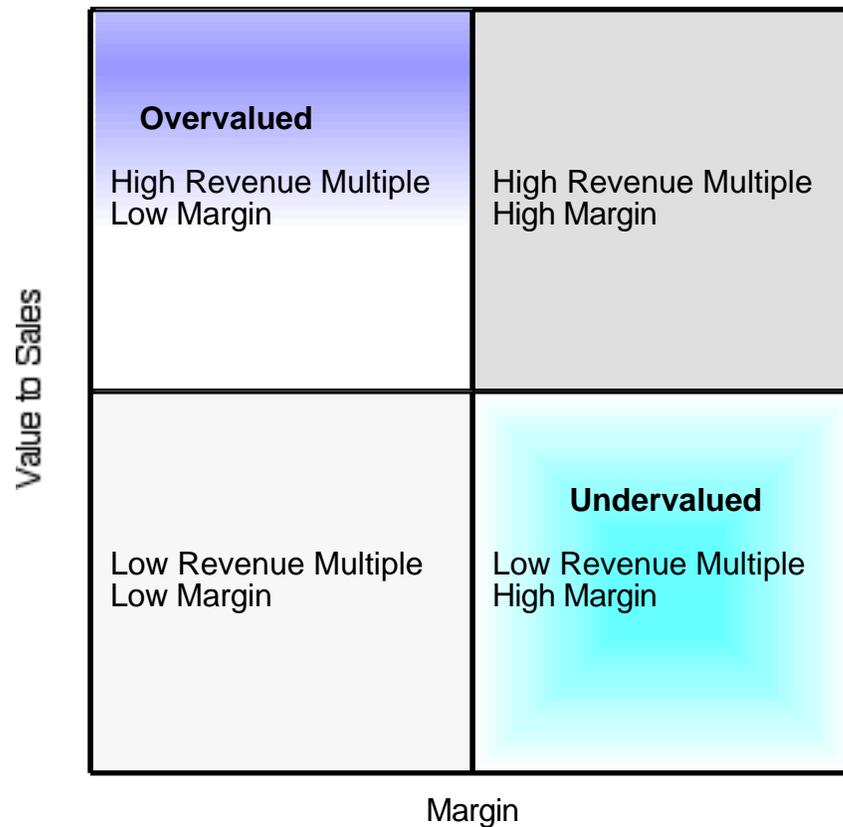
Using Revenue Multiples in Investment Analysis

The key determinants of the revenue multiples of a firm are its expected margins (net and operating), risk, cashflow and growth characteristics. To use revenue multiples in analysis and to make comparisons across firms, you would need to control for differences on these characteristics. In this section, we examine different ways of comparing revenue multiples across firms.

Looking for Mismatches

While growth, risk and cash flow characteristics affect revenue multiples, the key determinants of revenue multiples are profit margins – net profit margin for equity multiples and operating margins for firm value multiples. Thus, it is not surprising to find firms with low profit margins and low revenue multiples and firms with high profit margins and high revenue ratios. However, firms with high revenue ratios and low profit margins as well as firms with low revenue ratios and high profit margins should attract investors' attention as potentially overvalued and undervalued securities, respectively. This is presented in a matrix in Figure 20.3.

Figure 20.3: Value/Sales and Margins



You can identify under or over valued firms in a sector or industry by plotting them on this matrix and looking for potential mismatches between margins and revenue multiples.

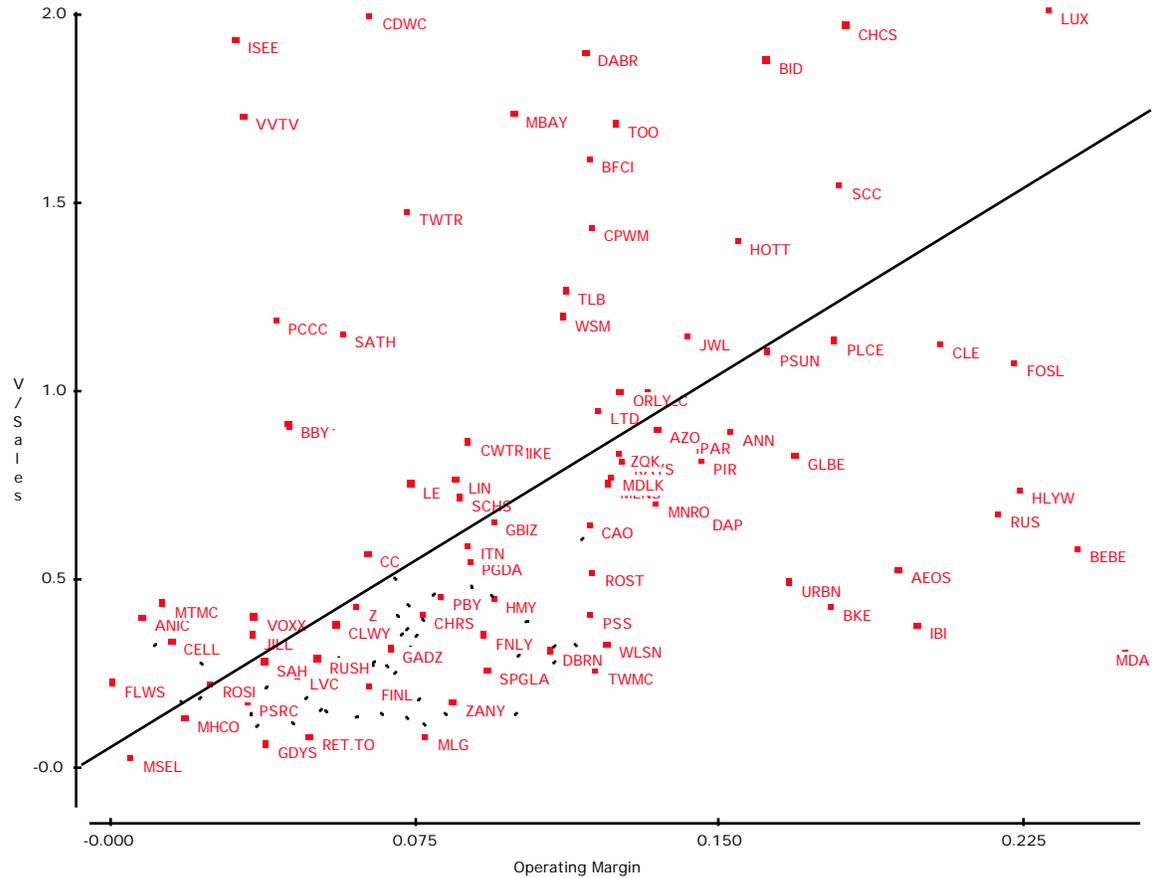
While intuitively appealing, there are at least three practical problems associated with this approach. The first is that data is more easily available on historical (current)

profit margins than on expected profit margins. If a firm's current margins are highly correlated with future margins – a firm that has earned high margins historically will continue to do so and one that have earned low margins historically will also continue to do so – using current margins and current revenue multiples to identify under or over valued securities is reasonable. If the current margins of firms are not highly correlated with expected future margins, it is no longer appropriate to argue that firms are over valued just because they have low current margins and trade at high price to sales ratios. The second problem with this approach is that it assumes that revenue multiples are linearly related to margins. In other words, as margins double, you would expect revenue multiples to double as well. The third problem is that it ignores differences on other fundamentals, especially risk. Thus, a firm that looks under valued because it has a high current margin and is trading at a low multiple of revenues may in fact be a fairly valued firm with very high risk.

Illustration 20.9: Revenue Multiples and Margins: Specialty Retailers

In the first comparison, we look at specialty retailers with positive earnings in the most recent financial year. In Figure 20.4, the value to sales ratios of these firms are plotted against the operating margins of these firms (with the stock symbols for each firm next to each observation).

Figure 20.4: Value to Sales Ratios and Operating Margins

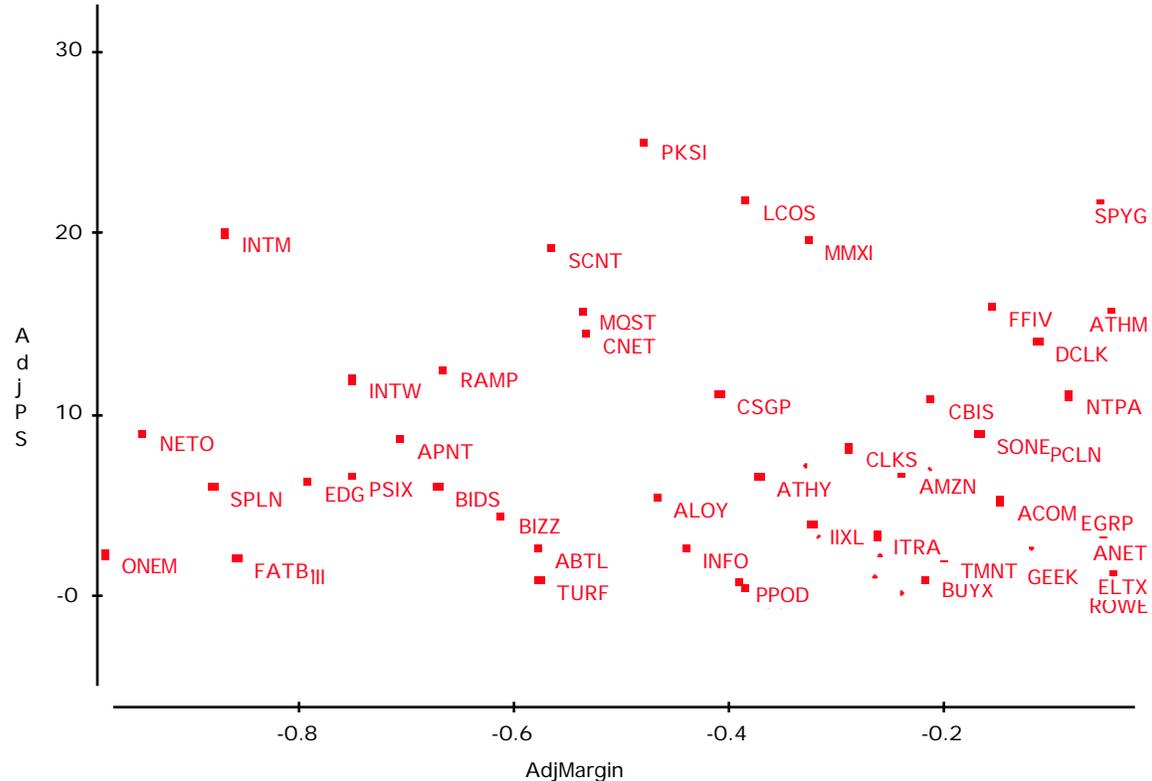


Firms with higher operating margins tend to have higher value to sales ratios, while firms with lower margin have lower value to sales ratios. Note, though, that there is a considerable amount of noise even in this sub-set of firms in the relationship between value to sales ratios and operating margins.

Illustration 20.10: Revenue Multiples and Margins: Internet Retailers

In the second comparison, the price to sales ratios of internet retailers are plotted against the net margins earned by these firms in the most recent year in Figure 20.5.

Figure 20.5: Price to Sales Ratios versus Net Margins: Internet Stocks



Here, there seems to be almost no relationship between price to sales ratios and net margins. This should not be surprising. Most internet firms have negative net income and net margins. The market values of these firms are based not upon what they earn now but what they are expected to earn in the future and there is little correlation between current and expected future margins.

Statistical Approaches

When analyzing price earnings and price to book value ratios, we used regressions to control for differences in risk, growth and payout ratios across firms. We could also use regressions to control for differences across firms to analyze revenue multiples. In this section, we begin by applying this approach to comparables defined narrowly as firms in the same business and then expanded to cover the entire sector and the market.

A. Comparable Firms in the Same Business

In the last section, we examined firms in the same business looking for mismatches – firms with high margins and low revenue multiples were viewed as under valued. In a

simple extension of this approach, we could regress revenue multiples against profit margins across firms in a sector.

$$\text{Price to Sales Ratio} = a + b (\text{Net Profit Margin})$$

$$\text{Value to Sales Ratio} = a + b (\text{After-tax Operating Margin})$$

These regressions can be used to estimate predicted values for firms in the sample, helping to identify under and over valued firms.

If the number of firms in the sample is large enough to allow for it, this regression can be extended to add other independent variables. For instance, the standard deviation in stock prices or the beta can be used as an independent variable to capture differences in risk and analyst estimates of expected growth can control for differences in growth. The regression can also be modified to account for non-linear relationships between revenue multiples and any or all of these variables.

Can this approach be used for sectors such as the internet where there seems to be little or no relationship between revenue multiples and fundamentals? It can, but only if you adapt it to consider the determinants of value in these sectors.

Illustration 20.11: Regression Approach – Specialty Retailers

Consider again the scatter plot of value to sales ratios and operating margins for retailers in Illustration 20.9. There is clearly a positive relationship and a regression of value to sales ratios against operating margins for specialty retailers yields the following.

$$\text{Value to Sales Ratio} = 0.0563 + 6.6287 \text{ After-tax Operating Margin} \quad R^2 = 39.9\%$$

(10.39)

This regression has 162 observations and the t-statistics are reported in brackets. The predicted value to sales ratio for Talbots, one of the specialty retailers in the group, which has an after-tax operating margin of 11.22%, can be estimated.

$$\text{Predicted Value to Sales Ratio} = 0.0563 + 6.6287(0.1122) = 0.80$$

With an actual value to sales ratio of 1.27, Talbot's can be considered over valued.

This regression can be modified in two ways. One is to regress the value to sales ratio against the $\ln(\text{operating margins})$ to allow for the non-linear logarithmic relationship between the two variables.

$$\text{Value to Sales Ratio} = 1.8313 + 0.4339 \ln(\text{After-tax Operating Margin}) \quad R^2 = 22.40\%$$

(6.89)

The other is to expand the regression to include proxies for risk and growth.

$$\text{Value to Sales} = -0.6209 + 7.21 (\text{At Op Mgn}) - 0.0209 \text{ OpInc} + 3.1460 \text{ Growth}$$

(10.34) (0.22) (4.91)

Where

AT Op Mgn = After-tax operating margin

OpInc = Standard deviation in operating income over previous 5 years

Growth = Expected Growth Rate in earnings over next 5 years

This regression has fewer observations (124) than the previous two but a higher R squared of 50.09%. The predicted value to sales ratio for Talbot's using this regression can be estimated.

$$\begin{aligned} \text{Predicted Value to Sales} &= -0.6209 + 7.21 (0.1122) - 0.0209 (0.7391) + 3.1460 (0.225) \\ &= 0.88 \end{aligned}$$

Talbot's remains over valued even after adjusting for differences in growth and risk.

Illustration 20.12: Regression Approach – Internet Retailers

In the case of the internet stocks graphed in Illustration 20.10, the regression of price to sales ratios against net margins yields the following.

$$\text{Price to Sales Ratio} = 44.4495 - 0.7331 (\text{Net Margin}) \quad R^2 = 0.22\%$$

Not only is the R-squared close to zero, but the relationship between current net margins and price to sales ratios is negative. Thus, there is little relationship between the pricing of these stocks and their current profitability.

What variables might do a better job of explaining the differences in price to sales ratios across internet stocks? Consider the following propositions.

- Since this sample contains some firms with very little in revenues and other firms with much higher revenues, you would expect the firms with less in revenues to trade at a much higher multiple of revenues than firms with higher revenues. Thus, Amazon with revenues of almost \$2 billion can be expected to trade at a lower multiple of this value than iVillage with revenues of less than \$60 million.
- There is a high probability that some or many of these internet firms will not survive because they will run out of cash. A widely used measure of this potential for cash

problems is the cash burn ratio, which is the ratio of the cash balance to the absolute value of EBITDA (which is usually a negative number). Firms with a low cash burn ratio are at higher risk of running into a cash crunch and should trade at lower multiples of revenues.

- Revenue growth is a key determinant of value at these firms. Firms that are growing revenues more quickly are likely to reach profitability sooner, other things remaining equal.

The following regression relates price to sales ratios to the level of revenues ($\ln(\text{Revenues})$), the cash burn ratio (Absolute value of Cash/EBITDA) and revenue growth over the last year for internet firms.

$$\text{Price to Sales Ratio} = 37.18 - 4.34 \ln(\text{Revenue}) + 0.75 (\text{Cash/EBITDA}) + 8.37 \text{Growth}_{\text{Rev}}$$

(1.85) (0.95) (4.18) (1.06)

The regression has 117 observations and an R-squared of 13.83%. The coefficients all have the right signs, but are of marginal statistical significance. You could obtain a predicted price to sales ratio for Amazon.com in July 2000 in this regression of.

$$PS_{\text{Ashford.com}} = 37.18 - 4.34 \ln(1,920) + 0.75 (2.12) + 8.37 (1.4810) = 18.36$$

At its actual price to sales ratio of 6.69, Amazon looks significantly under valued relative to other internet firms.

In any case, the regressions are much too noisy to attach much weight to the predictions. In fact, the low explanatory power with fundamentals and the huge differences in measures of relative value should sound a note of caution on the use of multiples in sectors such as this one, where firms are in transition and changing dramatically from period to period.

B. Market Regressions

If you can control for differences across firms using a regression, you can extend this approach to look at much broader cross sections of firms. Here, the cross-sectional data is used to estimate the price to sales ratio as a function of fundamental variables - profit margin, dividend payout, beta and growth rate in earnings.

Consider first the technology sector. Regressing the price to sales ratio against net margins, growth rate in earnings, payout ratios and betas in July 2000 yields the following result.

$$PS = -8.48 + 30.37 (\text{Net Margin}) + 20.98 (\text{Growth Rate}) + 4.68 \text{ Beta} + 3.79 \text{ Payout}$$

$$(7.19) \quad (10.2) \qquad (10.0) \qquad (4.64) \quad (0.85)$$

There are 273 observations in this regression and the R-squared is 53.8%.

This approach can be extended to cover the entire market. In the first edition of this book, regressions of price-sales ratios on fundamentals - dividend payout ratio, growth rate in earnings, profit margin and beta – were run for each year from 1987 to 1991.

<i>Year</i>	<i>Regression</i>	<i>R squared</i>
1987	PS = 0.7894 + .0008 PAYOUT - 0.2734 BETA + 0.5022 EGR + 6.46 MARGIN	0.4434
1988	PS = 0.1660 + .0006 PAYOUT - 0.0692 BETA + 0.5504 EGR + 10.31 MARGIN	0.7856
1989	PS = 0.4911 + .0393 PAYOUT - 0.0282 BETA + 0.2836 EGR + 10.25 MARGIN	0.4601
1990	PS = 0.0826 + .0105 PAYOUT - 0.1073 BETA + 0.5449 EGR + 10.36 MARGIN	0.8885
1991	PS = 0.5189 + 0.2749 PAYOUT - 0.2485 BETA + 0.4948 EGR + 8.17 MARGIN	0.4853

where,

PS = Price /Sales Ratio at the end of the year

MARGIN = Profit Margin for the year = Net Income / Sales for the year (in %)

PAYOUT = Payout Ratio = Dividends / Earnings at the end of the year

BETA = Beta of the stock

EGR = Earnings Growth rate over the previous five years

This regression is updated for the entire market in July 2000.

$$PS = -2.36 + 17.43 (\text{Net Margin}) + 8.72 (\text{Growth Rate}) + 1.45 \text{ Beta} + 0.37 \text{ Payout}$$

$$(16.5) \quad (35.5) \qquad (23.9) \qquad (10.1) \quad (3.01)$$

There are 2235 observations in this regression and the R-squared is 52.5%.

Multiples of Future Revenues

In Chapter 18, the use of market value of equity as a multiple of earnings in a future year was examined. Revenue multiples can also be measured in terms of future revenues. Thus, you could estimate the value as a multiple of revenues five years from now. There are several advantages to doing this.

- For firms, like CommerceOne, that have little in revenues currently but are expected to grow rapidly over time, the revenues in the future – say five years from now - are likely to better reflect the firm's true potential than revenues today. CommerceOne's revenues grow from \$402 million in the current year to an expected \$4.86 billion in five years, reflecting the high expected growth over the period.
- It is easier to estimate multiples of revenues when growth rates have leveled off and the firm's risk profile is stable. This is more likely to be the case five years from now than it is today.

Assuming that revenues five years from now are to be used to estimate value, what multiple should be used on these revenues? You have three choices. One is to use the average multiples of value (today) to revenues today of comparable firms to estimate a value five years from now and then discount that value back to the present. Thus, if the average value to sales ratio of more mature comparable firms is 1.8, the value of CommerceOne can be estimated.

Revenues at CommerceOne in 5 years = \$4,860 million

Value of CommerceOne in 5 years = $\$4,860 \times 1.8 = \$8,748$ million

This could be discounted back at the cost of capital of 13.48% to the present to yield a value for the firm today.

Value of firm today = $\$8,748 / 1.348^5 = \$1,965$ million

The second approach is to estimate the forecast the expected revenue, in five years, for each of the comparable firms, and to divide these revenues by the current firm value. This multiple of current value to future revenues can be used to estimate the value today. To illustrate, if current value is 1.1 times revenues in 5 years for comparable firms, the value of CommerceOne can be estimated.

Revenues at CommerceOne in 5 years = \$4,860 million

$$\begin{aligned}
 &= (\text{Revenues in 5 years}) \left(\frac{\text{Value today}}{\text{Revenues}_{\text{year 5}} \text{ Comparable firms}} \right) \\
 \text{Value today} &= (4,860)(1.1) \\
 &= \$5,346 \text{ million}
 \end{aligned}$$

In the third approach, you can adjust the multiple of future revenues for differences in operating margin, growth and risk for differences between the firm and comparable firms. For instance, CommerceOne, five years from now, will have an expected operating margin of 14.83% and an expected growth rate of 19.57% over the following 5 years (years 6 through 10). A regression of value to sales ratio against operating margins and expected growth rates run across comparable firms today yields the following.

$$\text{Value to Sales} = 1.0834 + 3.0387 \text{ Operating Margin} + 8.1555 \text{ Growth} \quad R^2 = 73\%$$

Plug in CommerceOne's predicted values for expected growth and operating margins into this regression.

$$\text{Value to Sales}_{\text{CommerceOne in 5 years}} = 1.0834 + 3.0387 (0.1483) + 8.1555 (0.1957) = 3.13$$

The value of CommerceOne in five years can now be estimated using this multiple.

$$\text{Revenues at CommerceOne in 5 years} = \$4,860 \text{ million}$$

$$\text{Value of CommerceOne in 5 years} = \$4,860 * 3.13 = \$15,212 \text{ million}$$

$$\text{Value of CommerceOne today} = \$15,212 / 1.1348^5 = \$8,083 \text{ million}$$

Sector-specific Multiples

The value of a firm can be standardized using a number of sector specific multiples. The value of steel companies can be compared based upon market value per ton of steel produced and the value of electricity generators can be computed on the basis of kwh of power produced. In the last few years, analysts following new technology firms have become particularly inventive with multiples that range from value per subscriber for internet service providers to value per web site visitor for internet portals to value per customer for internet retailers.

Why analysts use sector-specific multiples and their limitations

The increase in the use of sector specific multiples in the last few years has opened up a debate about whether they are a good way to compare relative value. There are several reasons why analysts use sector-specific multiples.

- They link firm value to operating details and output. For analysts who begin with these forecasts – predicting the number of subscribers for an internet service provider, for instance – they provide a much more intuitive way of estimating value.
- Sector specific multiples can often be computed with no reference to accounting statements or measures. Consequently, they can be estimated for firms where accounting statements are non-existent, unreliable or just not comparable. Thus, you could compute the value per kwh sold for Latin American power companies and not have to worry about accounting differences across these countries.
- Though this is usually not admitted to, sector-specific multiples are sometimes employed in desperation because none of the other multiples can be estimated or used. For instance, an impetus for the use of sector-specific multiples for new economy firms was that they often had negative earnings and little in terms of book value or revenues.

Though it is understandable that analysts sometimes turn to sector specific multiples, there are two significant problems associated with their use.

- They feed into the tunnel vision that plagues analysts who are sector focused and thus allow entire sectors to become overpriced. Thus, a cable company trading at \$50 a subscriber might look cheap next to another one trading at \$125 a subscriber, but it is entirely possible that they are both over priced or under priced.
- As we will show later in this section, the relationship of sector-specific multiples to fundamentals is complicated and it is very difficult, consequently, to control for differences across firms when comparing them on these multiples.

Definitions of Sector-specific Multiples

The essence of sector specific multiples is that the way they are measured vary from sector to sector. In general, though, they share some general characteristics.

- The numerator is usually *enterprise value* – the market values of both debt and equity netted out against cash and marketable securities.
- The denominator is defined in terms of the *operating units* that generate revenues and profits for the firm.

For commodity companies such as oil refineries and gold mining companies, where revenue is generated by selling units of the commodity, the market value can be standardized by dividing by the value by the reserves that these companies have of the commodity.

$$\text{Value per commodity unit} = \frac{\text{Market Value of Equity} + \text{Market Value of Debt}}{\text{Number of units of the commodity in reserves}}$$

Oil companies can be compared on enterprise value per barrel of oil in reserves and gold mining companies on the basis of enterprise value per ounce of gold in reserves.

For manufacturing firms that produce a homogeneous product (in terms of quality and units), the market value can be standardized by dividing by the number of units of the product that the firm produces or has the capacity to produce.

$$\text{Value per unit product} = \frac{\text{Market Value of Equity} + \text{Market Value of Debt}}{\text{Number of units produced (or capacity)}}$$

For instance, steel companies can be compared based upon their enterprise value per ton of steel produced or in capacity.

For subscription-based firms such as cable companies, internet service providers and information providers (such as TheStreet.com), revenues come from the number of subscribers to the base service provided. Here, the value of a firm can be stated in terms of the number of subscribers.

$$\text{Value per Subscriber} = \frac{\text{Market Value of Equity} + \text{Market Value of Debt}}{\text{Number of Subscribers}}$$

In each of the above cases, you could make an argument for the use of a sector-specific multiple because the units (whether they be barrels of oil, kwh of electricity or a subscriber) generate the similar revenues. Sector multiples become much more problematic when the units used to scale value are not homogeneous. Let us consider two examples.

For retailers such as Amazon that generate revenue from customers who shop at their site, the value of the firm can be stated in terms of the number of regular customers.

$$\text{Value per Customer} = \frac{\text{Market Value of Equity} + \text{Market Value of Debt}}{\text{Number of Customers}}$$

The problem, here, is that amount spent by each customer can vary widely across the customers and it is not clear that a firm that looks cheap on this basis is under valued.

For internet portals that generate revenue from advertising revenues that are based upon traffic to the site, the revenues can be stated in terms of the number of visitors to the site.

$$\text{Value per Site Visitor} = \frac{\text{Market Value of Equity} + \text{Market Value of Debt}}{\text{Number of Visitors/Site}}$$

Here, again, the link between visitors and advertising revenues is neither clearly established nor obvious.

Determinants of Value

What are the determinants of value for these sector-specific multiples? Not surprisingly, they are the same as the determinants of value for other multiples – cash flows, growth and risk - though the relationship can be complex. The fundamentals that drive these multiples can be derived by going back to a discounted cash flow model stated in terms of these sector-specific variables.

Consider an internet service provider that has NX existing subscribers and assume that each subscriber is expected to remain with the provider for the next n years. In addition, assume that the firm will generate net cash flows per customer (Revenues from each customer – Cost of serving the customer) of CFX per year for these n years¹. The value of each existing customer to the firm can then be written as:

$$\text{Value per customer} = VX = \sum_{t=1}^{t=n} \frac{CFX}{(1+r)^t}$$

The discount rate used to compute the value per customer can range from close to the riskless rate, if the customer has signed a contract to remain a subscriber for the next n

¹ For purposes of simplicity, it has been assumed that the cash flow is the same in each year. This can be generalized to allow cash flows to grow over time.

years, to the cost of capital, if the estimate is just an expectation based upon past experience.

Assume that the firm expects to continue to add new subscribers in future years and that the firm will face a cost (advertising and promotion) of C_t for each new subscriber added in period t . If the new subscribers (NX_t) added in period t will generate the a value VX_t per subscriber, the value of this firm can be written as:

$$\text{Value of Firm} = (NX)(VX) + \sum_{t=1}^{\infty} \frac{NX_t(VX_t - C_t)}{(1+k_c)^t}$$

Note that the first term in this valuation equation represents the value generated by existing subscriber and that the second is the value of expected growth. The subscribers added generate value only if the cost of adding a new subscriber (C_t) is less than the present value of the net cash flows generated by that subscriber for the firm.

Dividing both sides of this equation by the number of existing subscribers (NX).

$$\text{Value per existing subscriber} = \frac{\text{Value of Firm}}{NX} = VX + \sum_{t=1}^{\infty} \frac{NX_t(VX_t - C_t)}{NX(1+k_c)^t}$$

In the most general case, then, the value of a firm per subscriber will be a function not only of the expected value that will be generated by existing subscribers, but by the potential for value creation from future growth in the subscriber base. If you assume a competitive market, where the cost of adding new subscribers (C_t) converges on the value that is generated by that customer, the second term in the equation drops out and the value per subscriber becomes just the present value of cash flows that will be generated by each existing subscriber.

$$\text{Value per existing subscriber}_{C=VX} = VX$$

A similar analysis can be done to relate the value of an internet retailer to the number of customers it has, though it is generally much more difficult to estimate the value that will be created by a customer. Unlike subscribers who pay a fixed fee, retail customers buying habits are more difficult to predict.

In either case, you can see the problems associated with comparing these multiples across firms. Implicitly, you have to assume competitive markets and conclude that the firms with the lowest market value per subscriber are the most under valued.

Alternatively, you have to assume that the value of growth is the same proportion of the value generated by existing customers for all of the firms in your analysis. Either way, it leads to the same conclusion.

Value can also be related to the number of site visitors, but only if the link between revenues and the number of site visitors is made explicit. For instance, if an internet portal's advertising revenues are directly tied to the number of visitors at its site, the value of the internet portal can be stated in terms of the number of visitors to the site. Since sites have to spend money (on advertising) to attract visitors, it is the net value generated by each visitor that ultimately determines value.

Illustration 20.14: Estimating the Value per Subscriber: Internet Portal

Assume that you are valuing GOL, an internet service provider with 1 million existing subscribers. Each subscriber is expected to remain for 3 years and GOL is expected to generate \$100 in net after-tax cash flow (Subscription revenues – Costs of providing subscription service) per subscriber each year. GOL has a cost of capital of 15%. The value added to the firm by each existing subscriber can be estimated.

$$\text{Value per subscriber} = \sum_{t=1}^{t=3} \frac{100}{(1.15)^t} = \$228.32$$

Value of existing subscriber base = \$228.32 million

Furthermore, assume that GOL expects to add 100,000 subscribers each year for the next 10 years and that the value added by each subscriber will grow from the current level (\$228.32) at the inflation rate of 3% every year. The cost of adding a new subscriber is \$100 currently, assumed to be growing at the inflation rate.

Table 20.5: Value Added by New Subscribers

<i>Year</i>	<i>Value added/Subscriber</i>	<i>Cost of acquiring subscriber</i>	<i>Number of subscribers added</i>	<i>Present Value at 15%</i>
1	\$ 235.17	\$ 103.00	100,000	\$ 11,493,234
2	\$ 242.23	\$ 106.09	100,000	\$ 10,293,940
3	\$ 249.49	\$ 109.27	100,000	\$ 9,219,789
4	\$ 256.98	\$ 112.55	100,000	\$ 8,257,724

5	\$ 264.69	\$ 115.93	100,000	\$ 7,396,049
6	\$ 272.63	\$ 119.41	100,000	\$ 6,624,287
7	\$ 280.81	\$ 122.99	100,000	\$ 5,933,057
8	\$ 289.23	\$ 126.68	100,000	\$ 5,313,956
9	\$ 297.91	\$ 130.48	100,000	\$ 4,759,456
10	\$ 306.85	\$ 134.39	100,000	\$ 4,262,817
				\$ 73,554,309

The cumulative value added by new subscribers is \$73.55 million. The total value of the firm is the sum of the value generated by existing customers and the value added by new customers.

Value of Firm = Value of existing subscriber base + Value added by new customers

$$= \$ 228.32 \text{ million} + \$ 73.55 \text{ million} = \$ 301.87 \text{ million}$$

$$= \frac{\text{Value of Firm}}{\text{Number of subscribers}}$$

$$\text{Value per existing subscriber} = \frac{\$301.87 \text{ million}}{1 \text{ million}}$$

$$= \$301.87 \text{ per subscriber}$$

Note, though, that a portion of this value per subscriber is attributable to future growth. As the cost of acquiring a subscriber converges on the value added by each subscriber, the value per subscriber will converge on \$228.32.

Analysis using Sector-Specific Multiples

To analyze firms using sector-specific multiples, you have to control for the differences across firms on any or all of the fundamentals that you identified as affecting these multiples in the last part.

With value-per-subscriber, for instance, you have to control for differences in the value generated by each subscriber. In particular -

- Firms that are more efficient in delivering a service for a given subscription price (resulting in lower costs) should trade at a higher value per subscriber than comparable firms. This would also apply if a firm has significant economies of scale. In Illustration 20.14 above, the value per subscriber would be higher if each existing subscriber generated \$120 in net cash flows for the firm each year instead of \$100.

- Firms that can add new subscribers at a lower cost (advertising and promotion) should trade at a higher value per subscriber than comparable firms.
- Firms with higher expected growth in the subscriber base (in percentage terms) should trade at a higher value per subscriber than comparable firms.

You could make similar statements about value-per-customer.

With value per site visitor, you have to control for the additional advertising revenue that is generated by each visitor – the greater the advertising revenue, the higher the value per site visitor – and the cost of attracting each visitor – the higher the costs, the lower the value per site visitor.

Illustration 20.15: Comparing Value per Site Visitor

In Table 20.6, the market value per site visitor is presented for internet firms that generate the bulk of their revenues from advertising. The number of visitors per site was from July 1, 2000 to July 31, 2000 and the market value is as of July 31, 2000.

Table 20.6: Value per Visitor

<i>Company Name</i>	<i>Firm Value</i>	<i>Visitors</i>	<i>Value per visitor</i>
Lycos, Inc.	\$ 5,396.00	5,858	\$ 0.92
MapQuest.com Inc	\$ 604.80	6,621	\$ 0.09
iVillage Inc	\$ 250.40	7,346	\$ 0.03
CNET Networks	\$ 1,984.30	10,850	\$ 0.18
Ask Jeeves Inc	\$ 643.50	11,765	\$ 0.05
Go2Net Inc	\$ 1,468.60	12,527	\$ 0.12
LookSmart, Ltd.	\$ 1,795.30	13,374	\$ 0.13
About.com Inc	\$ 541.90	18,282	\$ 0.03
Excite@Home	\$ 7,008.20	27,115	\$ 0.26
Yahoo! Inc.	\$ 65,633.40	49,045	\$ 1.34

Source: Media Metrix

Note the differences in value per site visitor across Yahoo, Excite and Lycos. Excite looks much cheaper than either of the other two firms, but the differences could also be attributable to differences across the firms on fundamentals. It could be that Yahoo earns

more in advertising revenues than Excite and Lycos and that its prospects of earning higher profits in the future are brighter.

Conclusion

The price to sales multiple and value to sales are widely used to value technology firms and to compare value across these firms. An analysis of the fundamentals highlights the importance of profit margins in determining these multiples, in addition to the standard variables - the dividend payout ratio, the required rate of return, the expected growth rates for price to sales, the reinvestment rate and the risk for value to sales. Comparisons of revenue multiples across firms have to take into account differences in profit margins. One approach is to look for mismatches – low margins and high revenue multiples suggesting over valued firms and high margins and low revenue multiples suggesting under valued firms. Another approach that controls for differences in fundamentals is the cross-sectional regression approach, where revenue multiples are regressed against fundamentals across firms in a business, an entire sector or the market.

Sector-specific multiples relate value to sector specific variables but they have to be used with caution. It is often difficult to compare these multiples across firms without making stringent assumptions about their operations and growth potential.

Problems

1. Longs Drug, a large US drugstore chain operating primarily in Northern California, had sales per share of \$122 in 1993, on which it reported earnings per share of \$2.45 and paid a dividend per share of \$1.12. The company is expected to grow 6% in the long term and has a beta of 0.90. The current T.Bond rate is 7%.

- a. Estimate the appropriate price/sales multiple for Longs Drug.
- b. The stock is currently trading for \$34 per share. Assuming the growth rate is estimated correctly, what would the profit margin need to be to justify this price per share.

2. You are examining the wide differences in price/sales ratios that you can observe among firms in the retail store industry and trying to come up with a rationale to explain these differences.

Company	<u>Per-Share</u>				Expected Beta	Payout
	Price	Sales	Earnings	Growth		
Bombay Co.	\$ 38	\$ 9.70	\$ 0.68	29.00%	1.45	0 %
Bradlees	15	168.60	1.75	12.00%	1.15	34
Caldor	32	147.45	2.70	12.50%	1.55	0
Consolidated	21	23.00	0.95	26.50%	1.35	0
Dayton Hudson	73	272.90	4.65	12.50%	1.30	38
Federated	22	58.90	1.40	10.00%	1.45	0
Kmart	23	101.45	1.75	11.50%	1.30	59
Nordstrom	36	43.85	1.60	11.50%	1.45	20
Penney	54	81.05	3.50	10.50%	1.10	41
Sears	57	150.00	4.55	11.00%	1.35	36
Tiffany's	32	35.65	1.50	10.50%	1.50	19
Wal-Mart	30	29.35	1.05	18.50%	1.30	11
Woolworth	23	74.15	1.35	13.00%	1.25	65

- a. There are two companies that sell for more than revenues, the Bombay company and Wal-Mart. Why?
 - b. What is the variable that is most highly correlated with price-sales ratios?
 - c. Which of these companies is most likely to be over/under valued? How did you arrive at this judgment?
3. Walgreen, a large retail drugstore chain in the United States, reported net income of \$221 million in 1993 on revenues of \$8,298 million. It paid out 31% of its earnings as

dividends, a payout ratio that is expected to maintain between 1994 and 1998, during which period earnings growth is expected to be 13.5%. After 1998, earnings growth is expected to decline to 6% and the dividend payout ratio is expected to increase to 60%. The beta is 1.15 currently and is expected to remain unchanged. The treasury bond rate is 7%.

- a. Estimate the price/sales ratio for Walgreens, assuming its profit margin remains unchanged at 1993 levels.
- b. How much of this price/sales ratio can be attributed to extraordinary growth?

4. Tambrands, a leading producer of tampons, reported net income of \$122 million on revenues of \$684 million in 1992. Earnings growth was anticipated to be 11% over the next five years, after which it was expected to be 6%. The firm paid out 45% of its earnings as dividends in 1992 and this payout ratio was expected to increase to 60% during the stable period. The beta of the stock was 1.00.

During the course of 1993, erosion of brand loyalty and increasing competition for generic brands led to a drop in net income to \$100 million on revenues of \$700 million. The sales/book value ratio was comparable to 1992 levels.

(The treasury bond rate in 1992 and 1993 was 7%.)

- a. Estimate the price/sales ratio, based upon 1992 profit margins and expected growth.
- b. Estimate the price/sales ratio, based upon 1993 profit margins and expected growth (Assume that the extraordinary growth period remains 5 years, but that the growth rate will be impacted by the lower margins.)

5. Gillette Inc., the leading producer of grooming aids, was faced with a significant corporate strategy decision early in 1994 on whether it would continue its high-margin strategy or shift to a lower margin strategy to increase sales revenues in the face of intense generic competition. The two strategies are being considered.

Status Quo High-Margin Strategy

* Maintain profit margins at 1993 levels (In 1993, net income was \$575 million on revenues of \$5,750 million.) from 1994 to 2003.

* The sales/book value ratio, which was 3 in 1993, can then be expected to decline to 2.5 between 1994 and 2003.

Low-Margin Higher-Sales Strategy

* Reduce net profit margin to 8% from 1994 to 2003.

* The sales/book value ratio will then stay at 1993 levels from 1994 to 2003.

The book value per share at the end of 1993 is \$9.75. The dividend payout ratio, which was 33% in 1993, is expected to remain unchanged from 1994 to 2003 under either strategy, as is the beta, which was 1.30 in 1993. (The T.Bond rate is 7%)

After 2003, the earnings growth rate is expected to drop to 6% and the dividend payout ratio is expected to be 60% under either strategy. The beta will decline to 1.0.

- a. Estimate the price/sales ratio under the status quo strategy.
- b. Estimate the price/sales ratio under the low margin strategy.
- c. Which strategy would you recommend and why.
- d. How much would sales have to drop under the status quo strategy for the two strategies to be equivalent?

6. You have regressed price/sales ratios against fundamentals for NYSE stocks in 1994 and come up with the following regression.

$$PS = 0.42 + 0.33 \text{ PAYOUT} + 0.73 \text{ GROWTH} - 0.43 \text{ BETA} + 7.91 \text{ MARGIN}$$

For instance, a firm with a 35% payout, a 15% growth rate, a beta of 1.25 and a profit margin of 10% would have had a price/sales ratio of:

$$\begin{aligned} PS &= 0.42 + 0.33 * 0.35 + 0.73 * 0.15 - 0.43 * 1.25 + 7.91 * 0.10 \\ &= 0.8985 \end{aligned}$$

- a. What do the coefficients on this regression tell you about the independent variables relationship with the dependent variable? What statistical concerns might you have with this regression?
- b. Estimate the price/sales ratios for all the drugstore chains described in question 2. Why might this answer be different from the one obtained from the regression of only the drug store firms? Which one would you consider more reliable and why?