

Book Value Multiples

The relationship between price and book value has always attracted the attention of investors. Stocks selling for well below the book value of equity have generally been considered good candidates for undervalued portfolios, while those selling for more than book value have been targets for overvalued portfolios. This chapter begins by examining the price–book value ratio in more detail, the determinants of this ratio, and how best to evaluate or estimate the ratio.

In the second part of the chapter, we turn our attention to variants of the price-to-book ratio. In particular, we focus on the value-to-book ratio and Tobin's Q —a ratio of market value of assets to their replacement cost.

PRICE-TO-BOOK EQUITY

The market value of the equity in a firm reflects the market's expectation of the firm's earning power and cash flows. The book value of equity is the difference between the book value of assets and the book value of liabilities, a number that is largely determined by accounting conventions. In the United States, the book value of assets is the original price paid for the assets reduced by any allowable depreciation on the assets. Consequently, the book value of an asset decreases as it ages. The book value of liabilities similarly reflects the at-issue values of the liabilities. Since the book value of an asset reflects its original cost, it might deviate significantly from market value if the earning power of the asset has increased or declined significantly since its acquisition.

Why Analysts Use Book Value and the Downside

There are several reasons why investors find the price–book value ratio useful in investment analysis. The first is that the book value provides a relatively stable, intuitive measure of value that can be compared to the market price. For investors who instinctively mistrust discounted cash flow estimates of value, the book value is a much simpler benchmark for comparison. The second is that, given reasonably consistent accounting standards across firms, price–book value ratios can be compared across similar firms for signs of under- or overvaluation. Finally, even firms with negative earnings, which cannot be valued using price–earnings ratios, can be evaluated using price–book value ratios; there are far fewer firms with negative book value than there are firms with negative earnings.

There are several disadvantages associated with measuring and using price–book value ratios. First, book values, like earnings, are affected by accounting

decisions on depreciation and other variables. When accounting standards vary widely across firms, the price-book value ratios may not be comparable. A similar statement can be made about comparing price-book value ratios across countries with different accounting standards. Second, book value may not carry much meaning for service and technology firms that do not have significant tangible assets. Third, the book value of equity can become negative if a firm has a sustained string of negative earnings reports, leading to a negative price-book value ratio.

Definition

The price-to-book ratio is computed by dividing the market price per share by the current book value of equity per share.

$$\text{Price-to-book ratio} = \text{PBV} = \frac{\text{Price per share}}{\text{Book value of equity per share}}$$

While the multiple is fundamentally consistent—the numerator and denominator are both equity values—there is a potential for inconsistency if you are not careful about how you compute book value of equity per share. In particular,

- If there are multiple classes of shares outstanding, the price per share can be different for different classes of shares, and it is not clear how the book equity should be apportioned among shares.
- You should not include the portion of the equity that is attributable to preferred stock in computing the book value of equity, since the market value of equity refers only to common equity.

Some of the problems can be alleviated by computing the price-to-book ratio using the total market value of equity and book value of equity, rather than per-share values.

$$\text{Price-to-book ratio} = \text{PBV} = \frac{\text{Market value of equity}}{\text{Book value of equity}}$$

The safest way to measure this ratio when there are multiple classes of equity is to use the composite market value of all classes of common stock in the numerator and the composite book value of equity in the denominator—you would still ignore preferred stock for this computation.

There are two other measurement issues that you have to confront in computing this multiple. The first relates to the book value of equity, which as an accounting measure gets updated infrequently—once every quarter for U.S. companies and once every year for European companies. While most analysts use the most current book value of equity, there are some who use the average over the previous year or the book value of equity at the end of the latest financial year. Consistency demands that you use the same measure of book equity for all firms in your sample. The second and more difficult problem concerns the value of options outstanding. Technically, you would need to compute the estimated market value of management

options and conversion options (in bonds and preferred stock) and add them to the market value of equity before computing the price to book value ratio.¹ If you have a small sample of comparable firms and options represent a large portion of equity value, you should do this. With larger samples and less significant option issues, you can stay with the conventional measure of market value of equity.

Accounting standards can affect book values of equity and price to book ratios and skew comparisons made across firms. For instance, assume that you are comparing the price-to-book ratios of technology firms in two markets, and that one of them allows research expenses to be capitalized and the other does not. You should expect to see lower price-to-book value ratios in the former, since the book value of equity will be augmented by the value of the research asset.

ADJUSTING BOOK EQUITY FOR BUYBACKS AND ACQUISITIONS

In recent years, firms in the United States have increasingly turned to buying back stock as a way of returning cash to stockholders. When a firm buys back stock, the book equity of the firm declines by the amount of the buyback. Although this is precisely what happens when firms pay a cash dividend as well, buybacks tend to be much larger than regular dividends and thus have a bigger impact on book equity. To illustrate, assume that you have a firm that has a market value of equity of \$100 million and a book value of equity of \$50 million; its price-to-book ratio is 2.00. If the firm borrows \$25 million and buys back stock, its book equity will decline to \$25 million and its market equity will drop to \$75 million. The resulting price-to-book ratio is 3.

With acquisitions, the effect on price-to-book ratios can vary dramatically depending on how the acquisition is accounted for. If the acquiring firm uses purchase accounting, the book equity of the firm will increase by the market value of the acquired firm. If, however, it uses pooling, the book equity will increase by the book value of the acquired firm. Given that the book value is less than the market value for most firms, the price-to-book ratio will be much higher for firms that use pooling on acquisitions than for those that use purchase accounting.

To compare price-to-book ratios across firms when some firms in the sample buy back stocks and some do not or when there are wide differences in both the magnitude and the accounting for acquisitions can be problematic. One way to adjust for the differences is to take out the goodwill from acquisitions and to add back the market value of buybacks to the book equity to come up with an adjusted book value of equity. The price-to-book ratios can then be computed based on this adjusted book value of equity.

¹If you do not do this and compare price to book ratios across firms with widely different amounts of options outstanding, you could misidentify firms with more options outstanding as undervalued—the market value of traded common stock at these firms will be lower because of the option overhang.

Description

To get a sense of what comprises a high, low, or average price to book value ratio, we computed the ratio for every firm listed in the United States, and Figure 19.1 summarizes the distribution of price-to-book ratios in July 2000. Note that this distribution is heavily skewed, as is evidenced by the fact that the average price-to-book-value ratio of firms is 3.25 while the median price-to-book ratio is much lower at 1.85.

Another point worth making about price-to-book ratios is that there are firms with negative book values of equity—the result of continuously losing money—where price to book ratios cannot be computed. In this sample of 5,903 firms, there were 728 firms where this occurred. In contrast, though, 2,045 firms had negative earnings and PE ratios could not be computed for them.



pbvdata.xls: This dataset on the Web summarizes price-to-book ratios and fundamentals by industry group in the United States for the most recent year.

Analysis

The price-book value ratio can be related to the same fundamentals that determine value in discounted cash flow models. Since this is an equity multiple, we will use an equity discounted cash flow model—the dividend discount model—to explore the determinants. The value of equity in a stable growth dividend discount model can be written as:

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

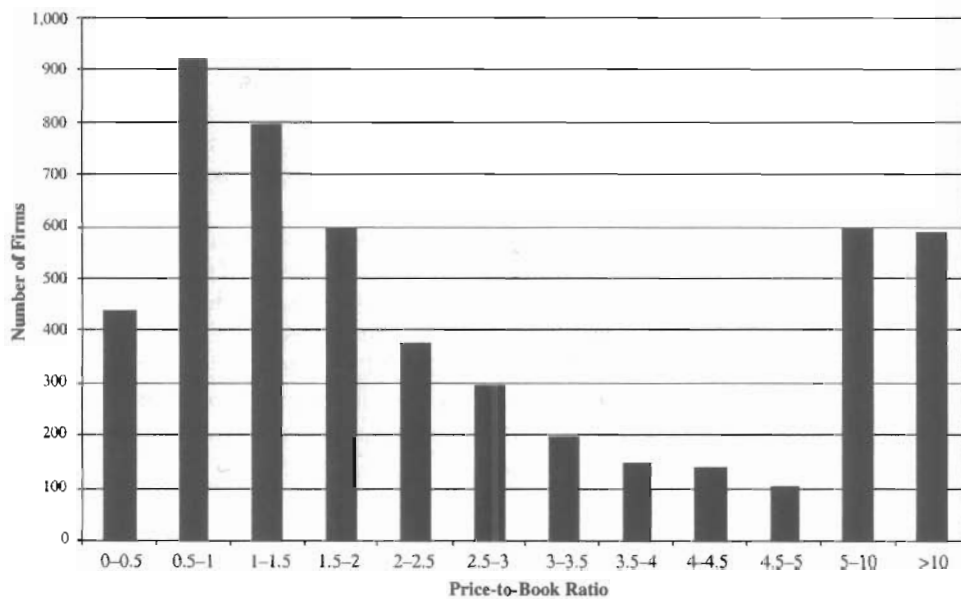


FIGURE 19.1 Price-to-Book Value Ratios—July 2000

Source: Value Line.

where P_0 = Value of equity per share today
 DPS_1 = Expected dividends per share next year
 k_e = Cost of equity
 g_n = Growth rate in dividends (forever)

Substituting for $DPS_1 = EPS_1(\text{Payout ratio})$, the value of the equity can be written as:

$$P_0 = \frac{EPS_1 \times \text{Payout ratio}}{k_e - g_n}$$

Defining the return on equity (ROE) = $EPS_1/\text{Book value of equity}_0$, the value of equity can be written as:

$$P_0 = \frac{BV_0 \times ROE \times \text{Payout ratio}}{k_e - g_n}$$

Rewriting in terms of the PBV ratio,

$$\frac{P_0}{BV_0} = \text{PBV} = \frac{ROE \times \text{Payout ratio}}{k_e - g_n}$$

If we define return on equity using contemporaneous earnings, $ROE = EPS_0/\text{Book value of equity}_0$, the price-to-book ratio can be written as:

$$\frac{P_0}{BV_0} = \frac{ROE \times (1 + g) \times \text{Payout ratio}}{k_e - g_n}$$

The PBV ratio is an increasing function of the return on equity, the payout ratio, and the growth rate, and a decreasing function of the riskiness of the firm.

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

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

Substituting back into the P/BV equation,

$$\frac{P}{BV} = \frac{(ROE - g_n)}{(k_e - g_n)}$$

The price-book value ratio of a stable firm is determined by the differential between the return on equity and its cost of equity. If the return on equity exceeds the cost of equity, the price will exceed the book value of equity; if the return on equity is lower than the cost of equity, the price will be lower than the book value of equity. The advantage of this formulation is that it can be used to estimate price-book value ratios for private firms that do not pay out dividends.

ILLUSTRATION 19.1: Estimating the PBV Ratio for a Stable Firm: Volvo

Volvo had earnings per share of 11.04 Swedish kroner (Sk) in 2000, and paid out a dividend of 7 Sk per share, which represented 63.41% of its earnings. The growth rate in earnings and dividends, in the long term, is expected to be 5%. The return on equity at Volvo is expected to be 13.66%. The beta for Volvo is 0.80, and the risk-free rate in Swedish kroner is 6.1%. (Market risk premium is 4%.)

Current dividend payout ratio = 63.41%

Expected growth rate in earnings and dividends = 5%

Return on equity = 13.66%

Cost of equity = $6.1\% + 0.80 \times 4\% = 9.30\%$

PBV ratio based on fundamentals = $\text{ROE} \times \text{Payout ratio} / (\text{Cost of equity} - \text{Growth rate})$
 $= 0.1366 \times 0.6341 / (.093 - .05) = 2.01$

Since the expected growth rate in this case is consistent with that estimated by fundamentals, the price-to-book ratio could also have been estimated from the return differences:

Fundamental growth rate = $(1 - \text{Payout ratio}) \times \text{ROE} = (1 - .6341) \times .1366 = .05$ or 5%

PBV ratio = $(\text{ROE} - \text{Growth rate}) / (\text{Cost of equity} - \text{Growth rate})$
 $= (.1366 - .05) / (.094 - .05) = 2.01$

Volvo was selling at a PBV ratio of 1.10 on the day of this analysis (May 2001), making it significantly undervalued. The alternative interpretation is that the market is anticipating a much lower return on equity in the future and pricing Volvo based on this expectation.

ILLUSTRATION 19.2: Estimating the Price-Book Value Ratio for a Privatization Candidate: Jenapharm (Germany)

One of the by-products of German reunification was the Treuhandanstalt, the German privatization agency set up to sell hundreds of East German firms to other German companies, individual investors, and the public. One of the handful of firms that seemed to be a viable candidate for privatization was Jenapharm, the most respected pharmaceutical manufacturer in East Germany. Jenapharm, which was expected to have revenues of 230 million DM in 1991, also was expected to report net income of 9 million DM in that year. The firm had a book value of assets of 110 million DM and a book value of equity of 58 million DM at the end of 1990.

The firm was expected to maintain sales in its niche product, a contraceptive pill, and grow at 5% a year in the long term, primarily by expanding into the generic drug market. The average beta of pharmaceutical firms traded on the Frankfurt Stock Exchange was 1.05, though many of these firms had much more diversified product portfolios and less volatile cash flows. Allowing for the higher leverage and risk in Jenapharm, a beta of 1.25 was used for Jenapharm. The 10-year bond rate in Germany at the time of this valuation in early 1991 was 7%, and the risk premium for stocks over bonds is assumed to be 3.5%.

Expected net income = 9 million DM

Return on equity = Expected net income/Book value of equity = $9/58 = 15.52\%$

Cost of equity = $7\% + 1.25(3.5\%) = 11.375\%$

Price-book value ratio = $(\text{ROE} - g) / (k_e - g) = (.1552 - .05) / (.11375 - .05) = 1.65$

Estimated MV of equity = BV of equity \times Price/BV ratio = $58 \times 1.65 = 95.70$ million DM

PBV Ratio for a High-Growth Firm

The price–book value 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. The value of equity of a high-growth firm in the two-stage dividend discount model can be written as:

$$\text{Value of equity} = \text{Present value of expected dividends} \\ + \text{Present value of terminal price}$$

When the growth rate is assumed to be constant after the initial high-growth phase, the dividend discount model can be written as follows:

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

where g = Growth rate in the first n years
 Payout = Payout ratio in the first n years
 g_n = Growth rate after n years forever (stable growth rate)
 Payout $_n$ = Payout ratio after n years for the stable firm
 k_e = Cost of equity (hg: high-growth period; st: stable-growth period)

Rewriting EPS_0 in terms of the return on equity, $\text{EPS}_0 = \text{BV}_0 \times \text{ROE}$, and bringing BV_0 to the left-hand side of the equation, we get:

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

where ROE is the return on equity and k_e is the cost of equity.

The left-hand side of the equation is the price–book value ratio. It is determined by:

- *Return on equity.* The price–book value ratio is an increasing function of the return on equity.
- *Payout ratio during the high-growth period and in the stable period.* The PBV ratio increases as the payout ratio increases, for any given growth rate.

- *Riskiness (through the discount rate r).* The PBV ratio becomes lower as riskiness increases; the increased risk increases the cost of equity.
- *Growth rate in earnings, in both the high-growth and stable phases.* The PBV increases as the growth rate increases, in either period, holding the payout ratio constant.

This formula is general enough to be applied to any firm, even one that is not paying dividends right now. Note, in addition, that the fundamentals that determine the price-to-book ratio are the same as they were for a stable growth firm—the payout ratio, the return on equity, the expected growth rate, and the cost of equity.

Chapter 14 noted that firms may not always pay out what they can afford to and recommended that the free cash flows to equity be substituted in for the dividends in those cases. You can, in fact, modify the equation to state the price-to-book ratio in terms of free cash flows to equity:

$$\frac{P_0}{BV_0} = ROE_{hg} \times \frac{\left[\frac{FCFE}{\text{Earnings}} \right]_{hg} \times (1+g) \times \left[1 - \frac{(1+g)^n}{(1+k_{e,hg})^n} \right]}{k_{e,hg}} + ROE_{st} \times \frac{\left[\frac{FCFE}{\text{Earnings}} \right]_n \times (1+g)^n \times (1+g_n)}{(k_{e,st} - g_n)(1+k_{e,hg})^n}$$

The only substitution that we have made is the replacement of the payout ratio by the FCFE as a percent of earnings. Note that we have also generalized the equation to allow the return on equity to be different in stable growth.

ILLUSTRATION 19.3: Estimating the PBV Ratio for a High-Growth Firm in the Two-Stage Model

Assume that you have been asked to estimate the PBV ratio for a firm that is expected to be in high growth for the next five years. The firm has the following characteristics:

EPS growth rate in first five years = 20%
 EPS growth rate after five years = 8%
 Beta = 1.0
 Return on equity = 25%
 Cost of equity = 6% + 1(5.5%) = 11.5%

Payout ratio in first five years = 20%
 Payout ratio after five years = 68%
 Risk free rate = T-bond rate = 6%

$$PBV = 0.25 \times \left[\frac{(0.2)(1.20) \left(1 - \frac{1.20^5}{1.115^5} \right)}{0.115 - 0.20} \right] + 0.25 \times \left[\frac{(0.68)(1.20^5)(1.08)}{(0.115 - 0.08)(1.115^5)} \right] = 7.89$$

The estimated PBV ratio for this firm is 7.89.

ILLUSTRATION 19.4: Estimating the Price-Book Value Ratio for a High-Growth Firm Using FCFE—Nestlé

In Chapter 14, we valued Nestlé using a two-stage FCFE model. We summarize the inputs we used for that valuation in the following table:

	High Growth	Stable Growth
Length	10 years	Forever after year 10
ROE	22.98%	15%
FCFE/Earnings	68.35%	73.33%
Growth rate	7.27%	4%
Cost of equity	8.47%	8.47%

The price-book value ratio, based on these inputs, is calculated as follows:

$$PBV = 0.2298 \times \frac{0.6835 \times (1.0727) \times \left[1 - \frac{(1.0727)^{10}}{(1.0847)^{10}} \right]}{(.0847 - .0727)} + 0.15 \times \frac{0.7333 \times (1.0727)^5 \times (1.04)}{(.0847 - .04)(1.0847)^{10}} = 3.77$$

Nestlé traded at a price-book value ratio of 4.40 in May 2001, which would make it overvalued.

Again, in this valuation, we have preserved consistency by setting the growth rate equal to the product of the return on equity and the equity reinvestment rate ($1 - \text{FCFE/Earnings}$):

$$\begin{aligned} \text{Growth rate during high growth} &= \text{ROE}(1 - \text{FCFE/Earnings}) \\ &= .2298(1 - .6835) = .0727 \end{aligned}$$

$$\begin{aligned} \text{Growth rate during stable growth} &= \text{ROE}(1 - \text{FCFE/Earnings}) \\ &= .15(1 - .7333) = .04 \end{aligned}$$

PBV Ratios and Return on Equity

The ratio of price to book value is strongly influenced by the return on equity. A lower return on equity affects the price-book value ratio directly through the formulation specified in the prior section and indirectly by lowering the expected growth or payout.

$$\text{Expected growth rate} = \text{Retention ratio} \times \text{Return on equity}$$

The effects of lower return on equity on the price-book value ratio can be seen by going back to Illustration 19.3 and changing the return on equity for the firm valued in that example.

ILLUSTRATION 19.5: Return on Equity and Price-Book Value

In Illustration 19.3, we estimated a price to book ratio for the firm of 7.89, based on a return on equity of 25%. This return on equity, in turn, allowed the firm to generate growth rates of 20% in high growth and 8% in stable growth:

$$\text{Growth rate in first five years} = \text{Retention ratio} \times \text{ROE} = 0.8 \times 25\% = 20\%$$

$$\text{Growth rate after year 5} = \text{Retention ratio} \times \text{ROE} = 0.32 \times 25\% = 8\%$$

If the firm's return on equity drops to 12%, the price-book value ratio will reflect the drop. The lower return on equity will also lower expected growth in the initial high-growth period:

$$\begin{aligned} \text{Expected growth rate (first five years)} &= \text{Retention ratio} \times \text{Return on equity} \\ &= 0.80 \times 12\% = 9.6\% \end{aligned}$$

After year 5, either the retention ratio has to increase or the expected growth rate has to be lower than 8%. If the retention ratio is adjusted,

$$\text{New retention ratio after year 5} = \text{Expected growth}/\text{ROE} = 8\%/12\% = 66.67\%$$

$$\text{New payout ratio after year 5} = 1 - \text{Retention ratio} = 33.33\%$$

The new price-book value ratio can then be calculated as follows:

$$\text{PBV} = (0.12) \times \frac{(0.2)(1.096) \left(1 - \frac{(1.096)^5}{(1.115)^5} \right)}{0.115 - 0.096} + (0.12) \times \frac{(0.3333)(1.096)^5(1.08)}{(0.115 - 0.08)(1.115)^5} = 1.25$$

The drop in the ROE has a two-layered impact. First, it lowers the growth rate in earnings and/or the expected payout ratio, thus having an indirect effect on the PBV ratio. Second, it reduces the PBV ratio directly.

The price-book value ratio is also influenced by the cost of equity, with higher costs of equity leading to lower price-book value ratios. The influence of the return on equity and the cost of equity can be consolidated in one measure by taking the difference between the two—a measure of excess equity return. The larger the return on equity relative to the cost of equity, the greater is the price-book value ratio. In Illustrations 19.3 and 19.5, for instance, the firm, which had a cost of equity of 11.5 percent, went from having a return on equity that was 13.5 percent greater than the required rate of return to a return on equity that barely broke even (0.5 percent greater than the required rate of return). Consequently, its price-book value ratio declined from 7.89 to 1.25. Figure 19.2 shows the price-book value ratio as a function of the difference between the return on equity and cost of equity. Note that when the return on equity is equal to the cost of equity, the price is equal to the book value.

Determinants of Return on Equity The difference between return on equity and the cost of equity is a measure of a firm's capacity to earn excess returns in the business in which it operates. Corporate strategists have examined the determinants of the

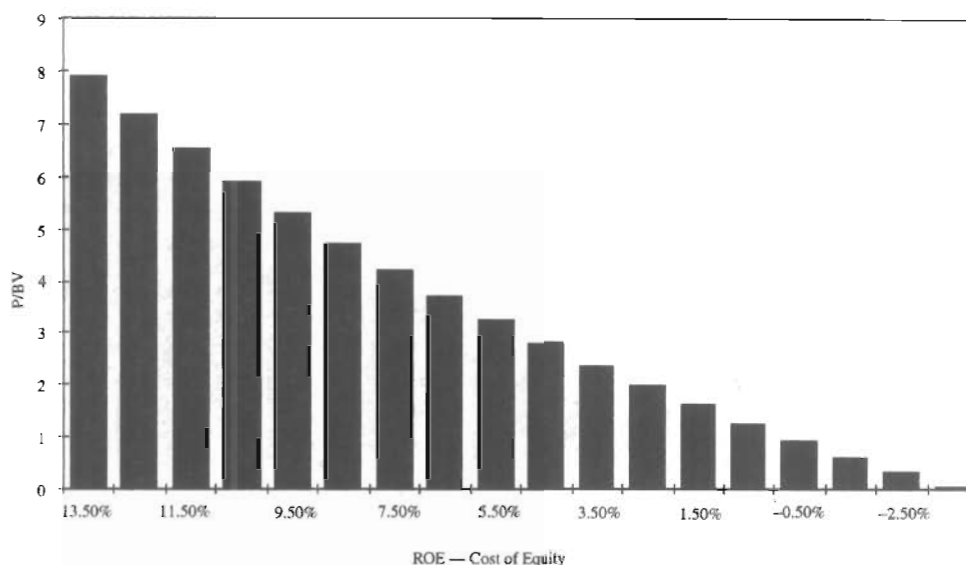


FIGURE 19.2 Price-Book Value as a Function of Return Differential

size and expected duration of these excess profits (and high ROE) using a variety of frameworks. One of the better known is the “five forces of competition” framework developed by Porter. In his approach, competition arises not only from established producers producing the same product but also from suppliers of substitutes and from potential new entrants into the market. Figure 19.3 summarizes the five forces of competition.

In Porter’s framework, a firm is able to maintain a high return on equity because there are significant barriers to entry by new firms or because the firm has significant advantages over its competition. The analysis of the return on equity of a firm can be made richer and much more informative by examining the competitive environment in which it operates. There may also be clues in this analysis to the future direction of the return on equity.



eqmult.xls: This spreadsheet allows you to estimate the price-earnings ratio for a stable-growth or high-growth firm, given its fundamentals.

APPLICATIONS OF PRICE-BOOK VALUE RATIOS

There are several potential applications for the principles developed in the preceding section, and we will consider three in this section. We will first look at what causes price-to-book ratios for entire markets to change over time, and when a low (high) price-to-book ratio for a market can be viewed as a sign of undervaluation or overvaluation. We will next compare the price-to-book ratios of firms within a sector, and extend this to look at firms across the market and what you need to

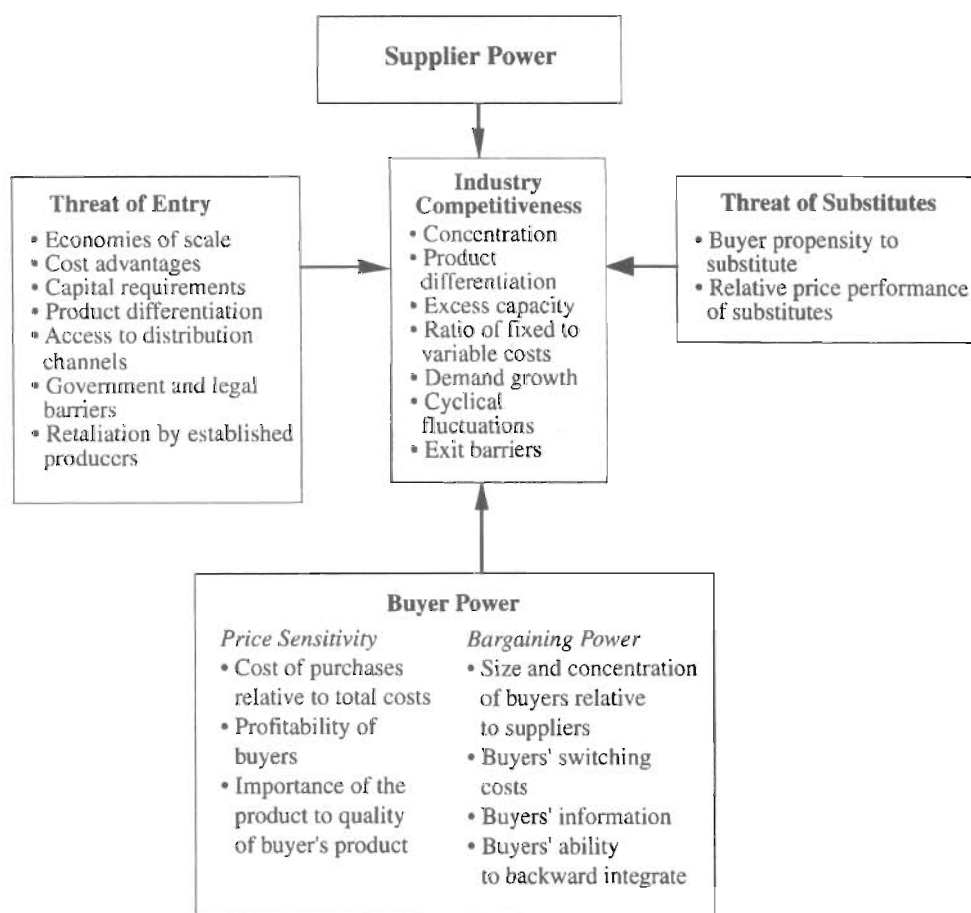


FIGURE 19.3 Forces of Competition and Return on Equity
Source: Porter.

control for in making these comparisons. Finally, we will look at the factors that cause the price-to-book ratio of an individual firm to change over time and how this can be used as a tool for analyzing restructurings.

PBV Ratios for a Market

The price-to-book value ratio for an entire market is determined by the same variables that determine the price-to-book value ratio for an individual firm. Other things remaining equal, therefore, you would expect the price-to-book ratio for a market to go up as the equity return spread (ROE minus cost of equity) earned by firms in the market increases. Conversely, you would expect the price-to-book ratio for the market to decrease as the equity return spread earned by firms decreases.

Chapter 18 noted the increase in the price-earnings ratio for the S&P 500 from 1960 to 2000. Over that period, the price-to-book value ratio for the market has also increased. Figure 19.4 reports on the price-to-book ratio for the S&P 500 and the return on equity for S&P 500 firms. The increase in the price-to-book ratio over

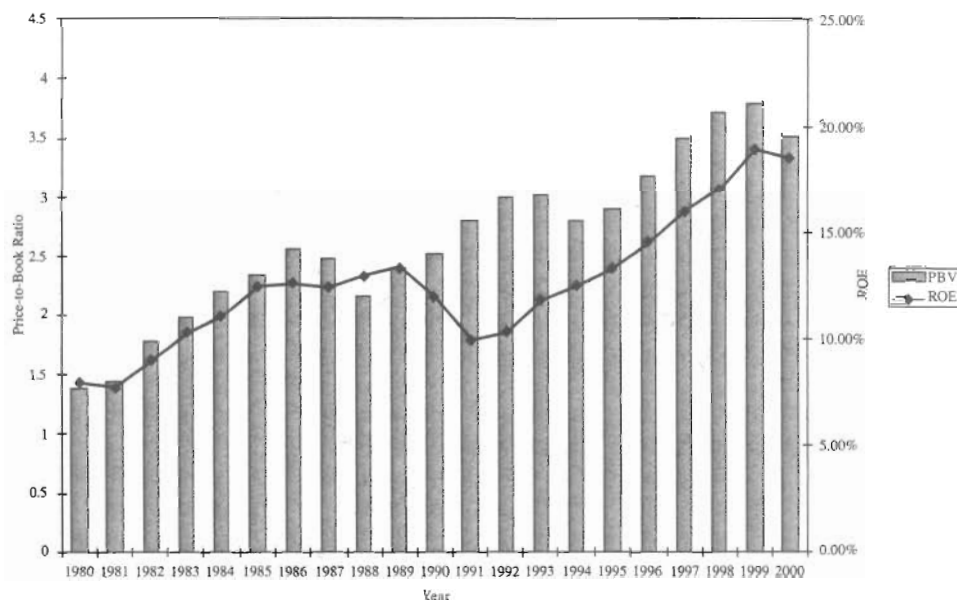


FIGURE 19.4 Price-to-Book Ratios and Return on Equity—S&P 500

Source: S&P.

the past two decades can be at least partially explained by the increase in return on equity over the same period.

Comparisons across Firms in a Sector

Price-book value ratios vary across firms for a number of reasons—different expected growth, different payout ratios, different risk levels, and most importantly, different returns on equity. Comparisons of price-book value ratios across firms that do not take into account these differences are likely to be flawed.

The most common approach to estimating PBV ratios for a firm is to choose a group of comparable firms, to calculate the average PBV ratio for this group, and to base the PBV ratio estimate for a firm on this average. The adjustments made to reflect differences in fundamentals between the firm being valued and the comparable group are usually made subjectively. There are several problems with this approach. First, the definition of a comparable firm is essentially a subjective one. The use of other firms in the industry as the control group is often not a complete solution because firms within the same industry can have very different business mixes and risk and growth profiles. There is also plenty of potential for bias. Second, even when a legitimate group of comparable firms can be constructed, differences will continue to persist in fundamentals between the firm being valued and this group. Adjusting for differences subjectively does not provide a satisfactory solution to this problem, since these judgments are only as good as the analysts making them.

Given the relationship between price-book value ratios and returns on equity, it is not surprising to see firms that have high returns on equity selling for well above book value and firms that have low returns on equity selling at or below book value. The firms that should draw attention from investors are those that provide mismatches of price-book value ratios and returns on equity—low PBV ratios

and high ROE, or high PBV ratios and low ROE. There are two ways in which we can bring home these mismatches—a matrix approach and a sector regression.

Matrix Approach If the essence of misvaluation is finding firms that have price-to-book ratios that do not go with their equity return spreads, the mismatch can be brought home by plotting the price-to-book value ratios of firms against their returns on equity. Figure 19.5 presents such a plot.

If we assume that firms within a sector have similar costs of equity, we could replace the equity return spread with the raw return on equity. Though we often use current returns on equity, in practice, the matrix is based on expected returns on equity in the future.

Regression Approach If the price-to-book ratio is largely a function of the return on equity, we could regress the former against the latter:

$$PBV = a + b ROE$$

If the relationship is strong, we could use this regression to obtain predicted price-to-book ratios for all of the firms in the sector, separating out those firms that are undervalued from those that are overvalued.

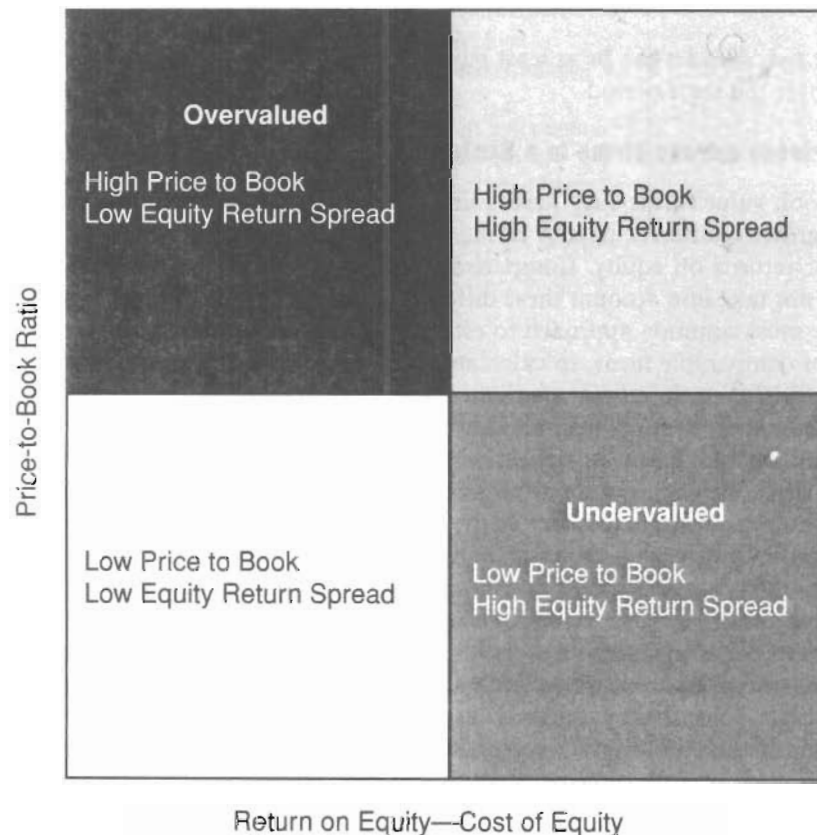


FIGURE 19.5 Price-to-Book Ratios and Return on Equity

This regression can be enriched in two ways. The first is to allow for nonlinear relationships between price-to-book and return on equity; this can be done either by transforming the variables (natural logs, exponentials, etc.) or by running nonlinear regressions. The second is to expand the regression to include other independent variables such as risk and growth.

ILLUSTRATION 19.6: Comparing Price-to-Book Value Ratios: Integrated Oil Companies

The following table reports on the price-to-book ratios for integrated oil companies listed in the United States in September 2000:

<i>Company Name</i>	<i>Ticker Symbol</i>	<i>Price-to-Book Ratio</i>	<i>Return on Equity</i>	<i>Standard Deviation</i>
Crown Central Petroleum "A"	CNPA	0.29	-14.60%	59.36%
Giant Industries	GI	0.54	7.47%	38.87%
Harken Energy Corp.	HEC	0.64	-5.83%	56.51%
Getty Petroleum Mktg.	GPM	0.95	6.26%	58.34%
Pennzoil-Quaker State	PZL	0.95	3.99%	51.06%
Ashland Inc.	ASH	1.13	10.27%	21.77%
Shell Transport	SC	1.45	13.41%	31.61%
USX-Marathon Group	MRO	1.59	13.42%	45.31%
Lakehead Pipe Line	LHP	1.72	13.28%	19.56%
Amerada Hess	AHC	1.77	16.69%	26.89%
Tosco Corp.	TOS	1.95	15.44%	34.51%
Occidental Petroleum	OXY	2.15	16.68%	39.47%
Royal Dutch Petroleum	RD	2.33	13.41%	29.81%
Murphy Oil Corp.	MUR	2.40	14.49%	27.80%
Texaco Inc.	TX	2.44	13.77%	27.78%
Phillips Petroleum	P	2.64	17.92%	29.51%
Chevron Corp.	CHV	3.03	15.69%	26.44%
Repsol-YPF ADR	REP	3.24	13.43%	26.82%
Unocal Corp.	UCL	3.53	10.67%	34.90%
Kerr-McGee Corp.	KMG	3.59	28.88%	42.47%
Exxon Mobil Corp.	XOM	4.22	11.20%	19.22%
BP Amoco ADR	BPA	4.66	14.34%	27.00%
Clayton Williams Energy	CWEI	5.57	31.02%	26.31%
Average		2.30	12.23%	

The average price-to-book ratio for the sector is 2.30, but the range in price-to-book ratios is large, with Crown Central trading at 0.29 times book value and Clayton Williams Energy trading at 5.57 times book value.

We will begin by plotting price-to-book ratios against returns on equity for these firms in Figure 19.6. While there are no firms that show up in the overvalued quadrant, firms such as Pennzoil (P), Occidental (OXY), Amerada Hess (AHC), and Murphy (MUR) look undervalued relative to the rest of the sector.

Regressing the price-to-book ratio against return on equity for oil companies, we obtained the following:

$$PBV = 1.043 + 10.24 ROE \quad R^2 = 48.6\%$$

[2.97] [4.46]

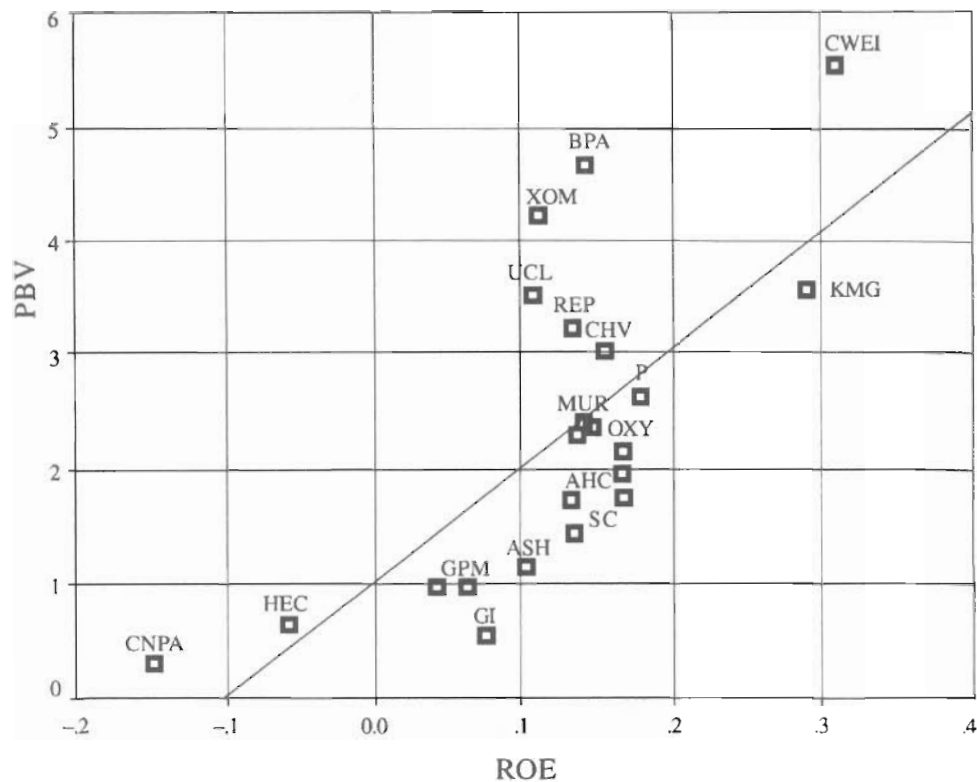


FIGURE 19.8 Price to Book versus Return on Equity: Oil Companies

If we extend this regression to include standard deviation in stock prices as a measure of risk, we get:

$$PBV = 2.21 + 8.22 \text{ ROE} - 2.63 \text{ Standard deviation} \quad R^2 = 52\%$$

[2.16] [2.92] [1.21]

This regression can be used to estimate predicted price-to-book ratios for these companies in the following table:

Company Name	Price-to-Book Ratio	Predicted PBV	Under- or Overvalued
Crown Central Petroleum "A"	0.29	-0.56	NMF
Giant Industries	0.54	1.80	-69.74%
Harken Energy Corp.	0.64	0.24	166.59%
Getty Petroleum Mktg.	0.95	1.19	-19.67%
Pennzoil-Quaker State	0.95	1.19	-19.93%
Ashland Inc.	1.13	2.48	-54.28%
Shell Transport	1.45	2.48	-41.56%
USX-Marathon Group	1.59	2.12	-25.11%
Lakehead Pipe Line	1.72	2.78	-38.03%
Amerada Hess	1.77	2.87	-38.33%

Company Name	Price-to-Book Ratio	Predicted PBV	Under- or Overvalued
Tosco Corp.	1.95	2.57	-24.09%
Occidental Petroleum	2.15	2.54	-15.27%
Royal Dutch Petroleum	2.33	2.52	-7.66%
Murphy Oil Corp.	2.40	2.67	-10.07%
Texaco Inc.	2.44	2.61	-6.47%
Phillips Petroleum	2.64	2.90	-9.17%
Chevron Corp.	3.03	2.80	8.20%
Repsol-YPF ADR	3.24	2.60	24.53%
Unocal Corp.	3.53	2.17	63.05%
Kerr-McGee Corp.	3.59	3.46	3.70%
Exxon Mobil Corp.	4.22	2.62	60.99%
BP Amoco ADR	4.66	2.67	74.03%
Clayton Williams Energy	5.57	4.06	36.92%

The most undervalued firm in the group is Giant Industries, with an actual price-to-book ratio of 0.54 and a predicted price-to-book ratio of 1.80, and the most overvalued is Harken Energy, with an actual price-to-book ratio of 0.64 and a predicted price-to-book ratio of 0.24.

Comparing Firms across the Market

In contrast to the comparable firm approach, you could look at how firms are priced across the entire market to predict PBV ratios for individual firms. The simplest way of summarizing this information is with a multiple regression, with the PBV ratio as the dependent variable, and proxies for risk, growth, return on equity, and payout forming the independent variables.

Past Studies The relationship between price-book value ratios and the return on equity has been highlighted in other studies. Wilcox (1984) posited a strong relationship between the price-to-book value ratio (plotted on a logarithmic scale) and return on equity. Using data from 1981 for 949 Value Line stocks, he arrived at the following equation:

$$\log(\text{Price/Book value}) = -1.00 + 7.51(\text{Return on equity})$$

He also found that this regression has much smaller mean squared error than competing models using price-earnings ratios and/or growth rates.

These PBV ratio regressions were updated in the first edition of this book using data from 1987 to 1991. The Compustat database was used to extract information on price-book value ratios, return on equity, payout ratios, and earnings growth rates (for the preceding five years) for all NYSE and AMEX firms with data available in each year. The betas were obtained from the CRSP tape for each year. All firms with negative book values were eliminated from the sample, and the regression of PBV on the independent variables yielded the following for each year:

Year	Regression	R-squared
1987	PBV = 0.1841 + .00200 Payout - 0.3940 Beta + 1.3389 EGR + 9.35 ROE	0.8617
1988	PBV = 0.7113 + 0.00007 Payout - 0.5082 Beta + 0.4605 EGR + 6.9374 ROE	0.8405
1989	PBV = 0.4119 + 0.0063 Payout - 0.6406 Beta + 1.0038 EGR + 9.55 ROE	0.8851
1990	PBV = 0.8124 + 0.0099 Payout - 0.1857 Beta + 1.1130 EGR + 6.61 ROE	0.8846
1991	PBV = 1.1065 + 0.3505 Payout - 0.6471 Beta + 1.0087 EGR + 10.51 ROE	0.8601

where PBV = Price/book value ratio at the end of the year
Payout = Dividend payout ratio at the end of the year
Beta = Beta of the stock
EGR = Growth rate in earnings over prior five years
ROE = Return on equity = Net income/Book value of equity

Updated Regressions In July 2000, we regressed the price-to-book ratios against the fundamentals identified in the preceding section—the return on equity, the payout ratio, the beta, and the expected growth rate over the next five years (from analyst forecasts):

$$\text{PBV} = -.59 + 8.93 \text{ ROE} + .0809 \text{ Payout ratio} + .917 \text{ Beta} + 7.55 \text{ Growth rate}$$

[3.76] [32.22] [3.06] [5.68] [18.37]

The regression has an R-squared of 43.2%.

The strong positive relationship between price to book ratios and returns on equity is not unique to the United States. In fact, Table 19.1 summarizes regressions for other countries of price-to-book ratios against returns on equity. In each of the markets, firms with higher returns on equity have higher price-to-book ratios, though the strength of the relationship is greater in Portugal and India and weaker in Greece and Brazil.

TABLE 19.1 Price to Book and Return on Equity: Market Regressions

Country	Regression Details	Regression Equation
Greece	May 2001 (Entire market: 272 firms)	PBV = 2.11 + 11.63 ROE ($R^2 = 17.5\%$)
Brazil	October 2000 (Entire market: 178 firms)	PBV = 0.77 + 3.78 ROE ($R^2 = 17.3\%$)
Portugal	June 1999 (Entire market: 74 firms)	PBV = -1.94 + 16.34 ROE + 2.83 Beta ($R^2 = 78\%$)
India	November 1997 (50 largest firms)	PBV = -1.68 + 24.03 ROE ($R^2 = 51\%$)

ILLUSTRATION 19.7: Valuing a Private Firm Using the Cross-Sectional Regression

Assume that you had been asked to value a private firm early in 2001 and that you had obtained the following data on the company:

Book value of equity = \$100 million
 Net income in 2000 = \$20 million
 Beta based on comparable firms = 1.20

Assume also that the firm reinvested \$12 million in 2000 and earnings are expected to grow 25% a year for the next five years. First compute the variables in the desired units:

Payout = $8/20 = 40\%$ (assuming free cash flow to equity is paid out as dividend)
 Earnings growth rate = 25%
 Return on equity = $20/100 = 20\%$
 Beta = 1.20

Predicted price–book value ratio = $-.59 + 8.93(.20) + .0809(.40) + .917(1.20) + 7.55(.25) = 4.2162$

Predicted market value of firm = $4.2162 \times 100 = 421.62$ million



pbvreg.htm: This dataset on the Web reports the results of the latest regression of PBV ratios against fundamentals, using all firms in the market.

CURRENT VERSUS EXPECTED RETURNS ON EQUITY

In all of the comparisons that we have made in this section, we have used a firm's current return on equity to make judgments about valuation. While it is convenient to focus on current returns, the market value of equity is determined by expectations of future returns on equity.

To the extent that there is a strong positive correlation between current ROE and future ROE, using the current return on equity to identify under- or overvalued companies is appropriate. Focusing on the current ROE can be dangerous, however, when the competitive environment is changing, and can lead to significant errors in valuation. In such cases, you should use a forecast return on equity that can be very different from the current return on equity. There are two ways to obtain this forecast:

1. Compute a historical average (over the past three or five years) of the return on equity earned by the firm and substitute this value for the current return on equity, when the latter is volatile.
2. Push the firm's current return on equity toward the industry average to reflect competitive pressures. For instance, assume that you are analyzing a computer software firm with a current return on equity of 35 percent and that the industry average return on equity is 20 percent. The forecast return on equity for this firm would be a weighted average of 20 percent and 35 percent, with the weight on the industry average increasing with the speed with which you expect the firm's return to converge on industry norms.

Comparing a Firm's Price-to-Book Ratio across Time

As a firm's return on equity changes over time, you would expect its price-to-book ratio to also change. Specifically, firms that increase their returns on equity should increase their price-to-book ratios and firms that see their returns on equity deteriorate should see a fall in their price-to-book ratios as well. Another way of thinking about this is in terms of the matrix presented in Figure 19.5, where we argued that firms with low (high) returns on equity should have low (high) price-to-book ratios. Thus, one way to measure the effect of the restructuring of a poorly performing firm (with low return on equity and low price-to-book ratio) is to see where it moves on the matrix. If it succeeds in its endeavor, it should move from the low PBV/low ROE quadrant toward the high PBV/high ROE quadrant. (See Figure 19.7.)

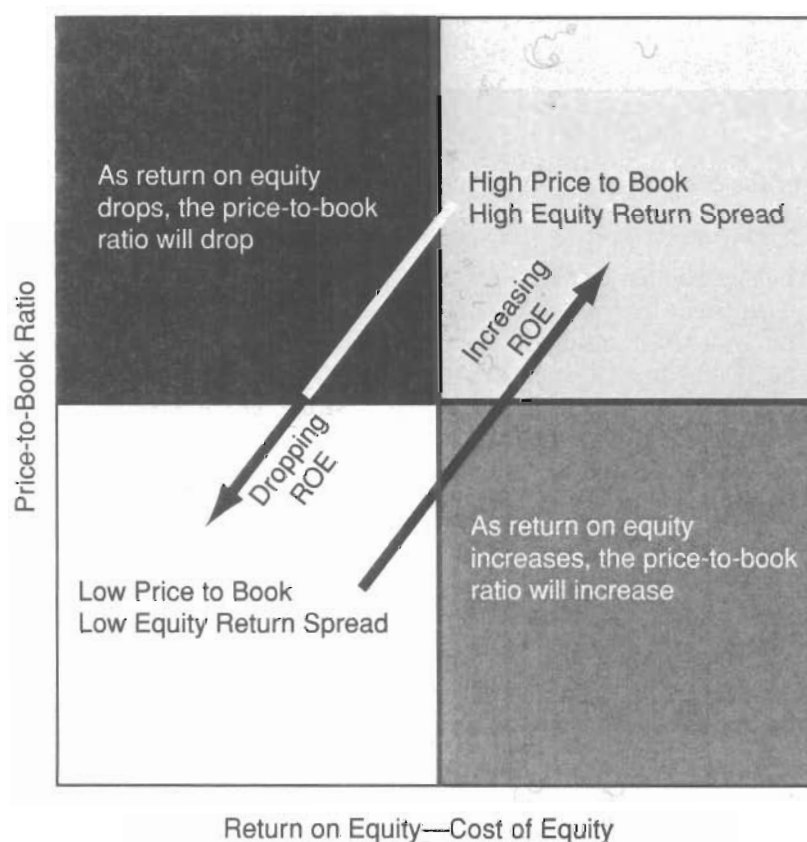


FIGURE 19.7 Changes in ROE and Changes in PBV Ratio

ILLUSTRATION 19.8: ROE and PBV Ratios: The Case of IBM

IBM provides a classic example of the effects of returns on equity on price-book value ratios. In 1983, IBM had a price which was three times its book value, one of the highest price-book value multiples among the Dow 30 stocks at that time. By 1992, the stock was trading at roughly book value, significantly lower than the average ratio for Dow 30 stocks. This decline in the price-book value ratio was triggered by the decline in return on equity at IBM, from 25% in 1983 and 1984, to negative levels in 1992 and 1993. In the years following Lou Gerstner becoming CEO, the firm has recovered dramatically and was trading at nine times book value in 1999. Figure 19.8 illustrates both PBV and ROE between 1983 and 2000 for IBM.

An investor buying IBM at its low point would have obtained a stock with a low price to book and a low return on equity, but her bet would have paid off. As the return on equity improved, IBM migrated from the bottom-left quadrant to the top-right quadrant in the matrix. As its price-to-book ratio improved, the investor would have seen substantial price appreciation and profits.

USE IN INVESTMENT STRATEGIES

Investors have used the relationship between price and book value in a number of investment strategies ranging from the simple to the sophisticated. Some have used low price-book value ratios as a screen to pick undervalued stocks. Others combine price-to-book value ratios with other fundamentals to make the same judgment. Finally, the sheer persistence of higher returns earned by low price-to-book

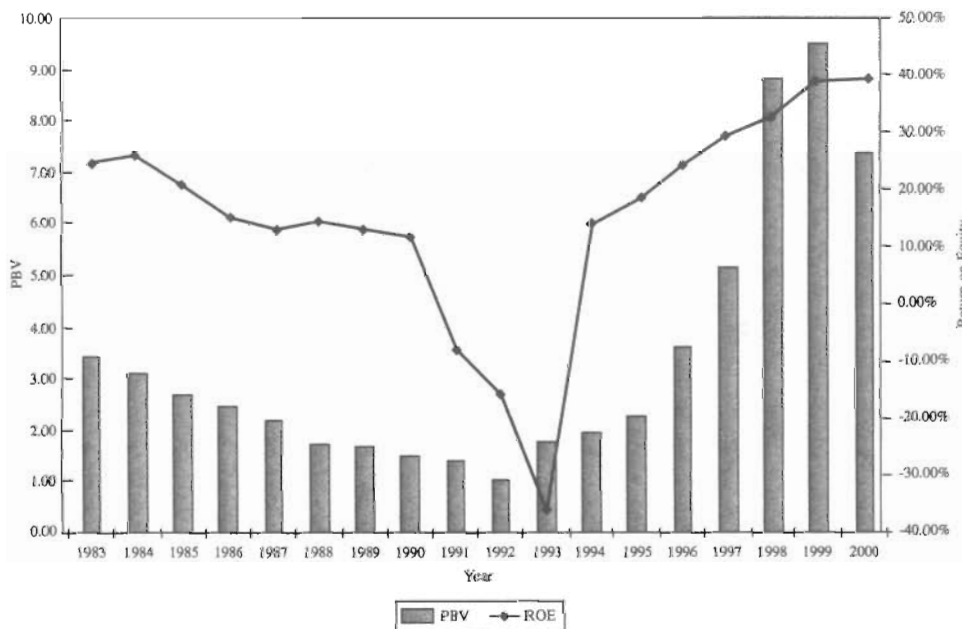


FIGURE 19.8 IBM: The Fall and Rise Again

stocks is viewed by some as an indication that price-to-book value ratio is a proxy for equity risk.

The Link to Excess Returns

Several studies have established a relationship between price-book value ratios and excess returns. Rosenberg, Reid, and Lanstein (1985) found that the average returns on U.S. stocks are positively related to the ratio of a firm's book value to market value. Between 1973 and 1984, the strategy of picking stocks with high book-price ratios (low price-book values) yielded an excess return of 36 basis points a month. Fama and French (1992), in examining the cross section of expected stock returns between 1963 and 1990, established that the positive relationship between book-to-price ratios and average returns persists in both the univariate and multivariate tests, and is even stronger than the small firm effect in explaining returns. When they classified firms on the basis of book-to-price ratios into 12 portfolios, firms in the lowest book-to-price (highest PBV) class earned an average monthly return of 0.30%, while firms in the highest book-to-price (lowest PBV) class earned an average monthly return of 1.83% for the 1963 to 1990 period.

Chan, Hamao, and Lakonishok (1991) found that the book-to-market ratio has a strong role in explaining the cross section of average returns on Japanese stocks. Capaul, Rowley, and Sharpe (1993) extended the analysis of price-book value ratios across other international markets between 1981 and 1992, and concluded that value stocks (stocks with low price-book value ratios) earned excess returns in every market that they analyzed. Their annualized estimates of the return differential earned by stocks with low price-book value ratios, over the market index, were as follows:

<i>Country</i>	<i>Added Return to Low PBV Portfolio</i>
France	3.26%
Germany	1.39%
Switzerland	1.17%
United Kingdom	1.09%
Japan	3.43%
United States	1.06%
Europe	1.30%
Global	1.88%

While this study is dated, the conclusion that lower price-to-book stocks earn higher returns than higher price-to-book stocks looks robust.

Using Price-Book Value Ratios as Investment Screens

The excess returns earned by firms with low price-book value ratios have been exploited by investment strategies that use price-book value ratios as a screen. Benjamin Graham, for instance, in his classic book on security analysis, listed price being less than two-thirds of book value as one of the criteria to be used to pick stocks.

The discussion in the preceding section emphasized the importance of return on equity in determining the price-book value ratio, and noted that only firms with high return on equity and a low price-book value ratio could be considered undervalued. This proposition was tested by screening all NYSE stocks from 1981 to 1990 on the basis of both price-book value ratios and returns on equity and creating two portfolios—an undervalued portfolio with low price-book value ratios (in bottom 25 percent of universe) and high returns on equity (in top 25 percent of universe), and an overvalued portfolio with high price-book value ratios (in top 25 percent of universe) and low returns on equity (in bottom 25 percent)—each year, and then estimating excess returns on each portfolio in the subsequent year. The following table summarizes returns on these two portfolios for each year from 1982 to 1991.

<i>Year</i>	<i>Undervalued Portfolio</i>	<i>Overvalued Portfolio</i>	<i>S&P 500</i>
1982	37.64%	14.64%	40.35%
1983	34.89%	3.07%	0.68%
1984	20.52%	-28.82%	15.43%
1985	46.55%	30.22%	30.97%
1986	33.61%	0.60%	24.44%
1987	-8.80%	-0.56%	-2.69%
1988	23.52%	7.21%	9.67%
1989	37.50%	16.55%	18.11%
1990	-26.71%	-10.98%	6.18%
1991	74.22%	28.76%	31.74%
1982-1991	25.60%	10.61%	17.49%

The undervalued portfolios significantly outperformed the overvalued portfolios in 8 out of 10 years, earning an average of 14.99 percent more per year between 1982 and 1991, and also had an average return significantly higher than the S&P 500.

Price to Book as a Proxy for Risk

The persistence of excess returns earned by firms with lower price-to-book ratios indicates either that the market is inefficient or that the price-to-book ratio is a proxy for equity risk. In other words, if lower price-to-book ratio stocks are viewed by the market as riskier than firms with higher price-to-book ratios, the higher returns earned by these stocks would be a fair return for this risk. In fact, this is the conclusion that Fama and French (1992) reached after examining the returns earned by lower price-to-book stocks.

While you cannot reject this hypothesis out of hand, you would need to put it to the test. What is the additional risk that low price-to-book stocks are exposed to? It is true that some low price-to-book ratio companies are highly levered and may not stay in business. For the most part, though, a portfolio composed of low price-to-book ratio stocks does not seem any more risky than a portfolio of high price-to-book stocks—their leverage and earnings variability are similar.

VALUE-TO-BOOK RATIOS

Instead of relating the market value of equity to the book value of equity, the value-to-book ratio relates the firm value to the book value of capital of the firm. Consequently, it can be viewed as the firm value analogue to the price-to-book ratio.

Definition

The value-to-book ratio is obtained by dividing the market value of both debt and equity by the book value of capital invested in a firm:

$$\text{Value-to-book ratio} = \frac{(\text{Market value of equity} + \text{Market value of debt})}{(\text{Book value of equity} + \text{Book value of debt})}$$

If the market value of debt is unavailable, the book value of debt can be used in the numerator as well. Needless to say, debt has to be consistently defined for both the numerator and denominator. For instance, if you choose to convert operating leases to debt for computing market value of debt, you have to add the present value of operating leases to the book value of debt as well.

There are two common variants of this multiple that do not pass the consistency test. One uses the book value of assets, which will generally exceed the book value of capital by the magnitude of current liabilities, in the denominator. This will result in price-to-book ratios that are biased down for firms with substantial current liabilities. The other uses the enterprise value in the numerator, with cash netted from the market values of debt and equity. Since the book value of equity incorporates the cash holdings of the firm, this will also bias the multiple down. If you decide to use enterprise value in the numerator, you would need to net cash out of the denominator as well.

$$\text{Enterprise value to book} = \frac{(\text{Market value of equity} + \text{Market value of debt} - \text{Cash})}{(\text{Book value of equity} + \text{Book value of debt} - \text{Cash})}$$

In addition, the multiple will need to be adjusted for a firm's cross holdings. The adjustment was described in detail for the enterprise value to EBITDA multiple in Chapter 18 and will require that you net out the portion of the market value and book value of equity that is attributable to subsidiaries.

Description

The distribution of the value-to-book ratio resembles that of the price-to-book ratio. Figure 19.9 presents this distribution for U.S. companies in July 2000. As with the other multiples, it is a heavily skewed distribution. The average value-to-book ratio is 2.93, slightly lower than the average price-to-book ratio computed for the same firms. The median value-to-book ratio is 1.40, which is also lower than the median price-to-book ratio.

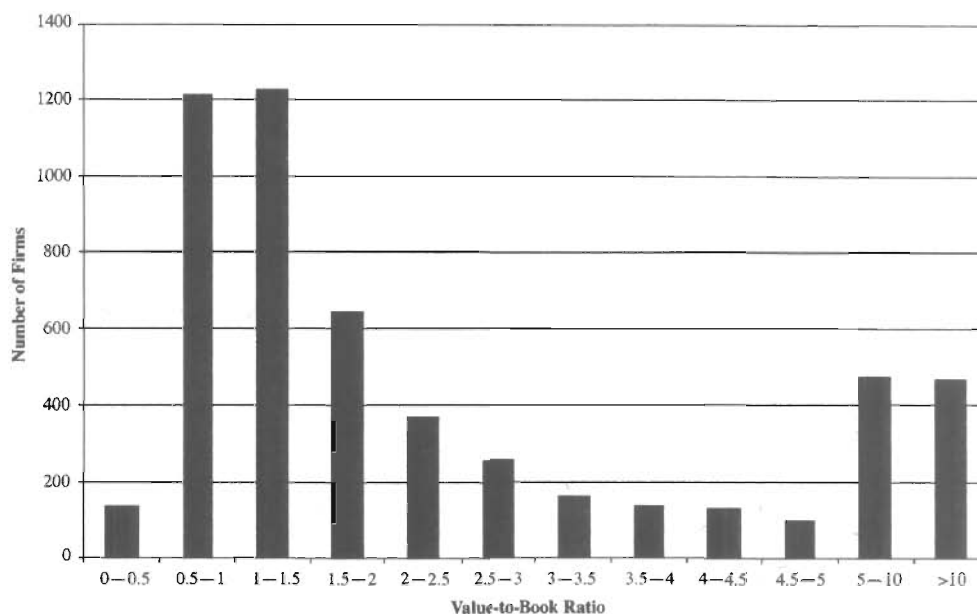


FIGURE 19.9 Value-to-Book Value Ratios

Source: Value Line.

One of the interesting by-products of switching from price-to-book ratios to value-to-book is that we lose no firms in the sample. In other words, the book value of equity can be negative, but the book value of capital is always positive.



pbvdata.xls: This dataset on the Web summarizes value to book multiples and fundamentals by industry group in the United States for the most recent year.

Analysis

The value-to-book ratio is a firm value multiple. To analyze it, we go back to a free cash flow to the firm valuation model, and use it to value a stable growth firm:

$$\text{Value} = \frac{\text{FCFF}_1}{(\text{Cost of capital} - g)}$$

Substituting in $\text{FCFF} = \text{EBIT}_1(1 - t)(1 - \text{Reinvestment rate})$, we get:

$$\text{Value} = \frac{\text{EBIT}_1(1 - t)(1 - \text{Reinvestment rate})}{(\text{Cost of capital} - g)}$$

Dividing both sides by the book value of capital, we get:²

$$\frac{\text{Value}}{\text{Book value of capital}} = \frac{\text{ROC}(1 - \text{Reinvestment rate})}{(\text{Cost of capital} - g)}$$

The value-to-book ratio is fundamentally determined by its return on capital—firms with high returns on capital tend to have high value-to-book ratios. In fact, the determinants of value-to-book mirror the determinants of price-to-book equity, but we replace equity measures with firm value measures—the ROE with the ROC, the cost of equity with the cost of capital, and the payout ratio with $(1 - \text{Reinvestment rate})$. In fact, if we substitute in the fundamental equation for the reinvestment rate:

$$\begin{aligned} \text{Reinvestment rate} &= g/\text{ROC} \\ \frac{\text{Value}}{\text{Book value of capital}} &= \frac{(\text{ROC} - g)}{(\text{Cost of capital} - g)} \end{aligned}$$

The analysis can be extended to cover high-growth firms, with the value-to-book capital ratio determined by the return on capital, cost of capital, growth rate, and reinvestment—in the high-growth and stable-growth periods:

$$\begin{aligned} \frac{\text{Value}_0}{\text{BV}_0} &= \text{ROC}_{\text{hg}} \times \frac{(1 - \text{RIR}_{\text{hg}}) \times (1 + g) \times \left[1 - \frac{(1 + g)^n}{(1 + k_{c,\text{hg}})^n} \right]}{k_{c,\text{hg}} - g} \\ &+ \text{ROC}_{\text{st}} \times \frac{(1 - \text{RIR}_{\text{st}}) \times (1 + g)^n \times (1 + g_n)}{(k_{c,\text{st}} - g_n)(1 + k_{c,\text{hg}})^n} \end{aligned}$$

where ROC = Return on capital (hg: high-growth period; st: stable-growth period)

RIR = Reinvestment rate (hg: high-growth period; st: stable-growth period)

k_c = Cost of capital (hg: high-growth period; st: stable-growth period)



firmmult.xls: This spreadsheet allows you to estimate firm value multiples for a stable-growth or high-growth firm, given its fundamentals.

Application

The value-to-book ratios can be compared across firms just as the price-to-book value of equity ratio was in the preceding section. The key variable to control for in making

²As with the return on equity, if return on capital is defined in terms of contemporaneous earnings ($\text{ROC} = \text{EBIT}_t / \text{Book capital}$), there will be an extra $(1 + g)$ in the numerator.

this comparison is the return on capital. The value matrix developed for price-to-book ratios can be adapted for the value-to-book ratio in Figure 19.10. Firms with high return on capital will tend to have high value-to-book value ratios, whereas firms with low return on capital will generally have lower value-to-book ratios.

This matrix also yields an interesting link to a widely used value enhancement measure—Economic Value Added (EVA). One of the biggest sales pitches for EVA, which is computed as the product of the return spread (ROC minus cost of capital) and capital invested, is its high correlation with MVA (which is defined as the difference between market value and book value of capital). This is not surprising, since MVA is a variant on the value-to-book ratio and EVA is a variant on the return spread.

Is the link between value-to-book and return on capital stronger or weaker than the link between price-to-book and return on equity? To examine this question, we regressed the value-to-book ratio against return on capital using data on all U.S. firms from January 2001:

$$\text{Value-to-book} = -0.40 + 4.78 \text{ ROC} + 11.48 \text{ Expected growth} + 0.39 \sigma_{oi} \quad R^2 = 41\%$$

[2.33] [24.0] [16.8] [1.39]

where σ_{oi} = Standard deviation in operating income

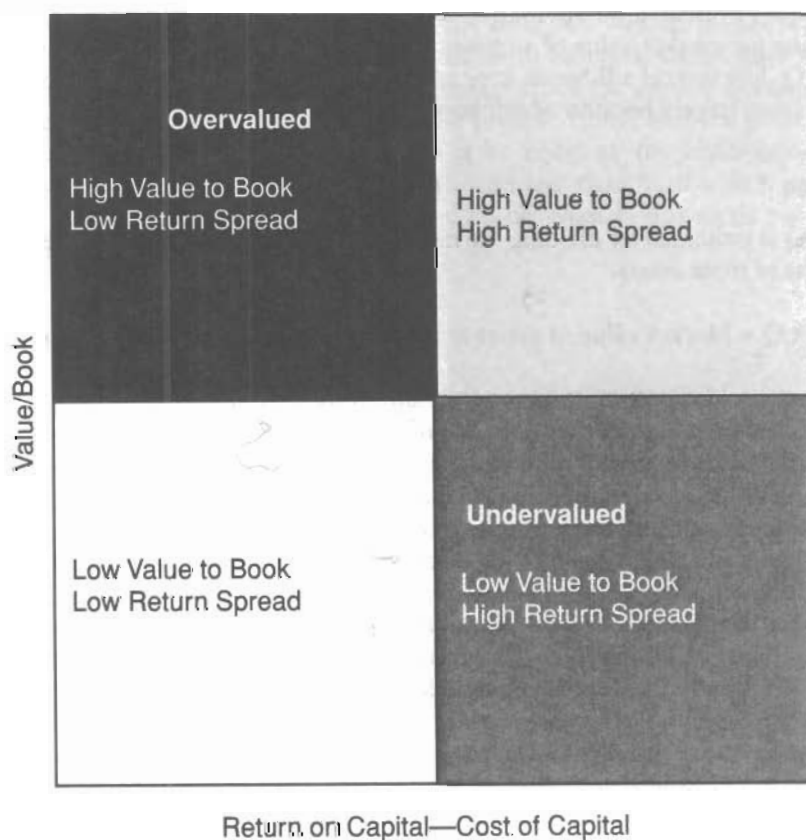


FIGURE 19.10 Valuation Matrix: Value to Book and Excess Returns

The regression yields results similar to those obtained for price-to-book ratios.

If the results from using value-to-book and price-to-book ratios parallel each other, why would you choose to use one multiple over the other? The case for using value-to-book ratios is stronger for firms that have high and/or shifting leverage. Firms can use leverage to increase their returns on equity, but in the process they also increase the volatility in the measure: In good times they report very high returns on equity, and in bad times, very low or negative returns on equity. For such firms, the value to book ratio and the accompanying return on capital will yield more stable and reliable estimates of relative value. In addition, the value-to-book ratio can be computed even for firms that have negative book values of equity and is thus less likely to be biased.



pbvreg.htm: This dataset on the Web reports the results of the latest regression of PE ratios against fundamentals, using all firms in the market.

TOBIN'S Q: MARKET VALUE/REPLACEMENT COST

James Tobin presented an alternative to traditional financial measures of value by comparing the market value of an asset to its replacement cost. His measure, called Tobin's Q, has several adherents in academia but still has not broken through into practical use, largely because of informational problems.

Definition

Tobin's Q is estimated by dividing the market value of a firm's assets by the replacement cost of these assets.

$$\text{Tobin's Q} = \text{Market value of assets in place} / \text{Replacement cost of assets in place}$$

In cases where inflation has pushed up the replacement cost of the assets or where technology has reduced the cost of the assets, this measure may provide a more updated measure of the value of the assets than accounting book value. The rationale for the measure is simple. Firms that earn negative excess returns and do not utilize their assets efficiently will have a Tobin's Q that is less than 1. Firms that utilize their assets more efficiently will trade at a Tobin's Q that exceeds 1.

While this measure has some advantages in theory, it does have some practical problems. The first is that the replacement value of some assets may be difficult to estimate, especially if assets are not traded on a market. The second is that even where replacement values are available, substantially more information is needed to construct this measure than the traditional price-book value ratio. In practice, analysts often use shortcuts to arrive at Tobin's Q, using book value of assets as a proxy for replacement value and market value of debt and equity as a proxy for the market value of assets. In these cases, Tobin's Q resembles the value-to-book value ratio described in the preceding section.

Description

If we use the strict definition of Tobin's Q, we cannot get a cross-sectional distribution of the multiple because the information to estimate it is neither easily accessible nor even available. This is a serious impediment to using the multiple because we have no sense of what a high, low, or average number for the multiple would be. For instance, assume that you find a firm trading at 1.2 times the replacement cost of the assets. You would have no way of knowing whether you were paying too much or too little for this firm without knowing the summary statistics for the market.

Analysis

The value obtained from Tobin's Q is determined by two variables—the market value of the firm and the replacement cost of assets in place. In inflationary times, where the cost of replacing assets increases over time, Tobin's Q will generally be lower than the unadjusted price–book value ratio, and the difference will increase for firms with older assets. Conversely, if the cost of replacing assets declines much faster than the book value (because of technological changes), Tobin's Q will generally be higher than the unadjusted price–book value ratio.

Tobin's Q is also determined by how efficiently a firm manages its assets and extracts value from them relative to the next best bidder. To see why, note that the market value of an asset will be equal to its replacement cost when assets earn their required return. (If the return earned on capital is equal to the cost of capital, investments have a zero net present value, and the present value of the cash flows from the investment will be equal to the replacement cost.) Carrying this logic forward, Tobin's Q will be less than 1, if a firm earns less than its required return on investments, and more than 1, if it earns positive excess returns.

Applications

Tobin's Q is a practical measure of value for a mature firm with most or all of its assets in place, where replacement cost can be estimated for the assets. Consider, for example, a steel company with little or no growth potential. The market value of this firm can be used as a proxy for the market value of its assets, and you could adjust the book value of the assets owned by the firm for inflation. In contrast, estimating the market value of assets owned would be difficult for a high-growth firm, since the market value of equity for this firm will include a premium for future growth.

Tobin's Q is more a measure of the perceived quality of a firm's management than it is of misvaluation, with poorly managed firms trading at market values that are lower than the replacement cost of the assets that they own. In fact, several studies have examined whether such firms are more likely to be taken over. Lang, Stulz, and Walkling (1991) concluded that firms with low Tobin's Q are more likely to be taken over for purposes of restructuring and increasing value. They also find that shareholders of high q bidders gain significantly more from successful tender offers than shareholders of low q bidders.

CONCLUSION

The relationship between price and book value is much more complex than most investors realize. The price-book value ratio of a firm is determined by its expected payout ratio, its expected growth rate in earnings, and its riskiness. The most important determinant, however, is the return on equity earned by the firm—higher returns lead to higher price-book value ratios, and lower returns lead to lower PBV ratios. The mismatch that should draw investor attention is the one between return on equity and price-book value ratios—high price-book value ratios with low returns on equity (overvalued) and low price-book value ratios with high returns on equity (undervalued).

The value-to-book ratio is the firm value analogue to the price-to-book ratio, and it is a function of the return on capital earned by the firm, its cost of capital, and reinvestment rate. Again, though, firms with low value-to-book ratios and high expected returns on capital can be viewed as undervalued.

QUESTIONS AND SHORT PROBLEMS

1. Answer true or false to the following statements, with a short explanation.
 - a. A stock that sells for less than book value is undervalued.
True ____ False ____
 - b. If a company's return on equity drops, its price/book value ratio will generally drop more than proportionately (i.e., if the return on equity drops by half, the price/book value ratio will drop by more than half).
True ____ False ____
 - c. A combination of a low price/book value ratio and a high expected return on equity suggests that a stock is undervalued.
True ____ False ____
 - d. Other things remaining equal, a higher-growth stock will have a higher price/book value ratio than a lower growth stock.
True ____ False ____
 - e. In the Gordon growth model, firms with higher dividend payout ratios will have higher price/book value ratios.
True ____ False ____
2. NCH Corporation, which markets cleaning chemicals, insecticides, and other products, paid dividends of \$2 per share in 1993 on earnings of \$4 per share. The book value of equity per share was \$40, and earnings are expected to grow 6% a year in the long term. The stock has a beta of 0.85, and sells for \$60 per share. (The Treasury bond rate is 7%, and the market risk premium is 5.5%.)
 - a. Based on these inputs, estimate the price/book value ratio for NCH.
 - b. How much would the return on equity have to increase to justify the price/book value ratio at which NCH sells for currently?
3. You are analyzing the price/book value ratios for firms in the trucking industry, relative to returns on equity and required rates of return. The data on the companies is as follows:

Company	PBV	ROE	Beta
Builders Transport	2.00	11.5%	1.00
Carolina Freight	0.60	5.5%	1.20
Consolidated Freight	2.60	12.0%	1.15
J.B. Hunt	2.50	14.5%	1.00
M.S. Carriers	2.50	12.5%	1.15
Roadway Services	3.00	14.0%	1.15
Ryder System	2.25	13.0%	1.05
Xtra Corporation	2.80	16.5%	1.10

The Treasury bond rate is 7%, and the market risk premium is 5.5%.

- Compute the average PBV ratio, return on equity, and beta for the industry.
 - Based on these averages, are stocks in the industry under- or overvalued relative to book values?
- United Healthcare, a health maintenance organization, is expected to have earnings growth of 30% for the next five years and 6% after that. The dividend payout ratio will be only 10% during the high growth phase, but will increase to 60% in steady state. The stock has a beta of 1.65 currently, but the beta is expected to drop to 1.10 in steady state. (The Treasury bond rate is 7.25%.)
 - Estimate the price/book value ratio for United Healthcare, given the inputs above.
 - How sensitive is the price/book value ratio to estimates of growth during the high growth period?
 - United Healthcare trades at a price/book value ratio of 7.00. How long would extraordinary growth have to last (at a 30% annual rate) to justify this PBV ratio?
 - Johnson & Johnson, a leading manufacturer of health care products, had a return on equity of 31.5% in 1993, and paid out 37% of its earnings as dividends. The stock had a beta of 1.25. (The Treasury bond rate is 6%, and the risk premium is 5.5%.) The extraordinary growth is expected to last for 10 years, after which the growth rate is expected to drop to 6% and the return on equity to 15% (the beta will move to 1).
 - Assuming the return on equity and dividend payout ratio continue at current levels for the high growth period, estimate the PBV ratio for Johnson & Johnson.
 - If health care reform passes, it is believed that Johnson & Johnson's return on equity will drop to 20% for the high growth phase. If the company chooses to maintain its existing dividend payout ratio, estimate the new PBV ratio for Johnson & Johnson. (You can assume that the inputs for the steady state period are unaffected.)
 - Assume that you have done a regression of PBV ratios for all firms on the New York Stock Exchange, and arrived at the following result:

$$\text{PBV} = 0.88 + 0.82 \text{ Payout} + 7.79 \text{ Growth} - 0.41 \text{ Beta} + 13.81 \text{ ROE} \quad R^2 = 0.65$$
 where Payout = Dividend payout ratio during most recent period
 Growth = Projected growth rate in earnings over next five years
 Beta = Beta of the stock in most current period

To illustrate, a firm with a payout ratio of 40%, a beta of 1.25, a ROE of 25%, and expected growth rate of 15% would have had a price/book value ratio of:

$$PBV = 0.88 + 0.82(0.4) + 7.79(.15) - 0.41(1.25) + 13.81(.25) = 5.3165$$

- a. What use, if any, would you put the R-squared of the regression to?
 - b. Assume that you have also run a sector regression on a company and estimated a price-to-book ratio based on that regression. Why might your result from the market regression yield a different result from the sector regression?
7. SoftSoap Corporation is a large consumer product firm that reported after-tax operating income of \$600 million in the just-completed financial year. At the beginning of the year, the firm reported book value of equity of \$4 billion and book value of debt of \$1 billion. The market value of equity is \$8 billion, the market value of debt is \$1 billion, and the firm has a cost of equity of 11% and an after-tax cost of debt of 4%. If the firm is in stable growth, expecting to grow 4% a year in perpetuity, estimate the correct value-to-book value ratio for the firm.
 8. Lyondell Inc. is a conglomerate with a value-to-book capital ratio of 2.0. If the firm is in stable growth, expecting to grow 4% a year in perpetuity, and has a cost of capital of 10%, what return on capital is the market assuming in perpetuity for Lyondell?
 9. Estimate the value-to-book capital ratio for Zapata Enterprises, a trading firm in high growth, with the following characteristics:

	<i>High Growth</i>	<i>Stable Growth</i>
After-tax return on capital	15%	12%
Expected growth rate	12%	4%
Cost of capital	10%	9%

If high growth is expected to last 10 years, estimate the correct value-to-book ratio for Zapata.

10. If Tobin's Q is computed by dividing the market value of traded equity and debt by the book value of assets, you will overestimate the value for high-growth firms. Explain why.