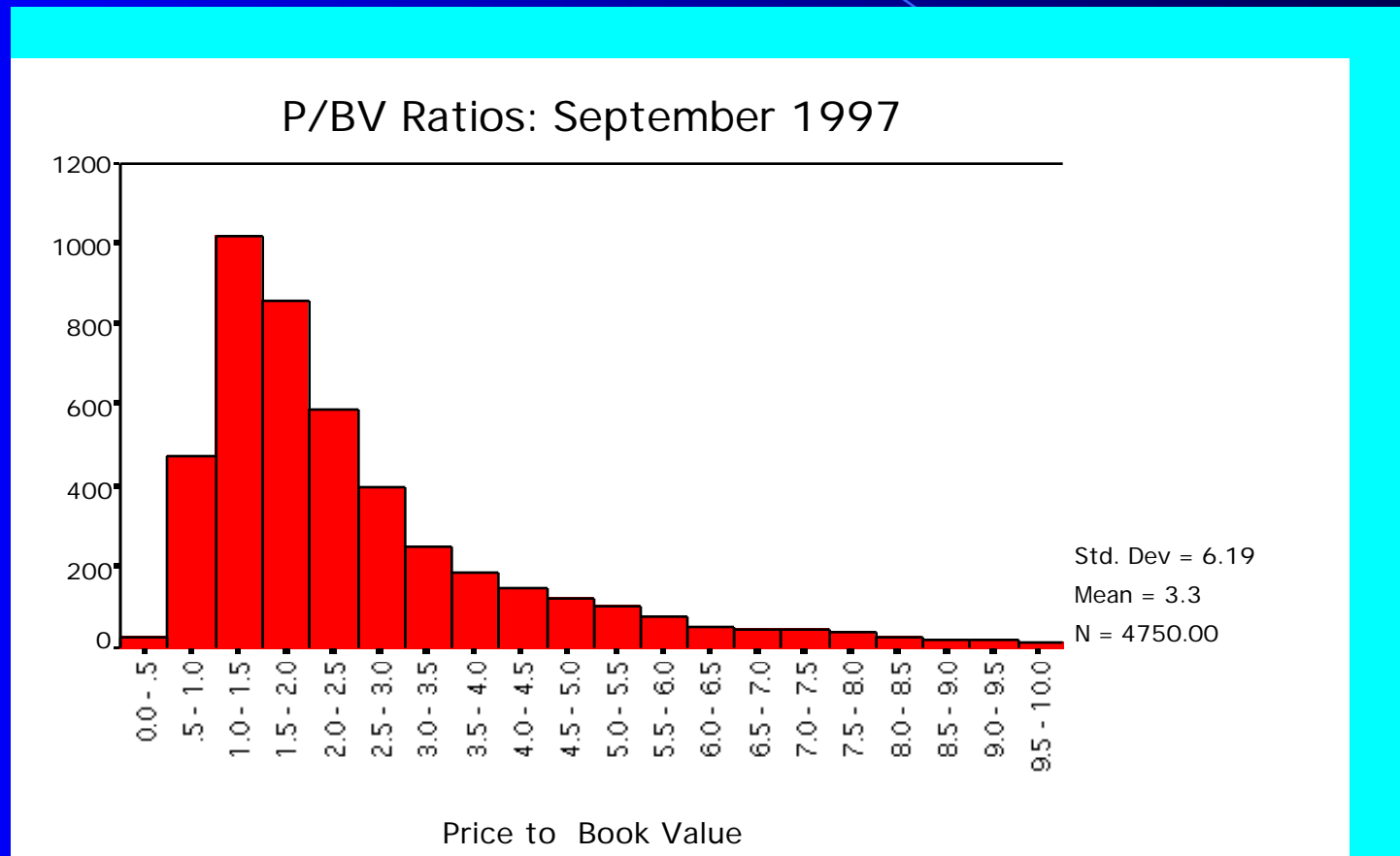


Price-Book Value Ratio: Definition

- The price/book value ratio is the ratio of the market value of equity to the book value of equity, i.e., the measure of shareholders' equity in the balance sheet.
- Price/Book Value =
$$\frac{\text{Market Value of Equity}}{\text{Book Value of Equity}}$$
- Consistency Tests:
 - If the market value of equity refers to the market value of equity of common stock outstanding, the book value of common equity should be used in the denominator.
 - If there is more than one class of common stock outstanding, the market values of all classes (even the non-traded classes) need to be factored in.

PBV Ratio: September 1997



Price Book Value Ratio: Stable Growth Firm

- Going back to a simple dividend discount model,

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

- Defining the return on equity (ROE) = $EPS_0 / \text{Book Value of Equity}$, the value of equity can be written as:

$$P_0 = \frac{BV_0 * ROE * \text{Payout Ratio} * (1 + g_n)}{r - g_n}$$

$$\frac{P_0}{BV_0} = \text{PBV} = \frac{ROE * \text{Payout Ratio} * (1 + g_n)}{r - g_n}$$

- If the return on equity is based upon expected earnings in the next time period, this can be simplified to,

$$\frac{P_0}{BV_0} = \text{PBV} = \frac{ROE * \text{Payout Ratio}}{r - g_n}$$

Price Book Value Ratio: Stable Growth Firm Another Presentation

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

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

- Substituting back into the P/BV equation,

$$\frac{P_0}{BV_0} = \text{PBV} = \frac{\text{ROE} - g_n}{r - g_n}$$

- The price-book value ratio of a stable firm is determined by the differential between the return on equity and the required rate of return on its projects.

Price Book Value Ratio for a Stable Growth Firm: Example

- Jenapharm was the most respected pharmaceutical manufacturer in East Germany.
- Jenapharm, which was expected to have revenues of 230 million DM and earnings before interest and taxes of 30 million DM in 1991.
- The firm had a book value of assets of 110 million DM, and a book value of equity of 58 million DM. The interest expenses in 1991 is expected to be 15 million DM. The corporate tax rate is 40%.
- 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.
- The ten-year bond rate in Germany at the time of this valuation was 7%; the risk premium for stocks over bonds is assumed to be 5.5%.

Estimating a Price/Book Ratio for Jenapharm

- Expected Net Income = $(\text{EBIT} - \text{Interest Expense}) \times (1 - t) = (30 - 15) \times (1 - 0.4) = 9 \text{ mil DM}$
- Return on Equity = $\text{Expected Net Income} / \text{Book Value of Equity} = 9 / 58 = 15.52\%$
- Cost on Equity = $7\% + 1.05 (5.5\%) = 12.775\%$
- Price/Book Value Ratio = $(\text{ROE} - g) / (r - g) = (.1552 - .05) / (.12775 - .05) = 1.35$
- Estimated MV of equity = $\text{BV of Equity} \times \text{Price/BV ratio} = 58 \times 1.35 = \78.3 mil DM

Price Book Value Ratio for High Growth Firm

- The Price-book ratio for a high-growth firm can be estimated beginning with a 2-stage discounted cash flow model:

$$P_0 = \frac{EPS_0 * \text{Payout Ratio} * (1+g) * \left[1 - \frac{(1+g)^n}{(1+r)^n} \right]}{r-g} + \frac{EPS_0 * \text{Payout Ratio}_n * (1+g)^n * (1+g_n)}{(r-g_n)(1+r)^n}$$

- Dividing both sides of the equation by the book value of equity:

$$\frac{P_0}{BV_0} = \frac{ROE * \text{Payout Ratio} * (1+g) * \left[1 - \frac{(1+g)^n}{(1+r)^n} \right]}{r-g} + \frac{ROE_n * \text{Payout Ratio}_n * (1+g)^n * (1+g_n)}{(r-g_n)(1+r)^n}$$

where ROE = Return on Equity in high-growth period
 ROE_n = Return on Equity in stable growth period

PBV Ratio for High Growth Firm: Example

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

	High Growth Phase	Stable Growth Phase
Length of Period	5 years	Forever after year 5
Return on Equity	25%	15%
Payout Ratio	20%	60%
Growth Rate	$.80 * .25 = .20$	$.4 * .15 = .06$
Beta	1.25	1.00
Cost of Equity	12.875%	11.50%

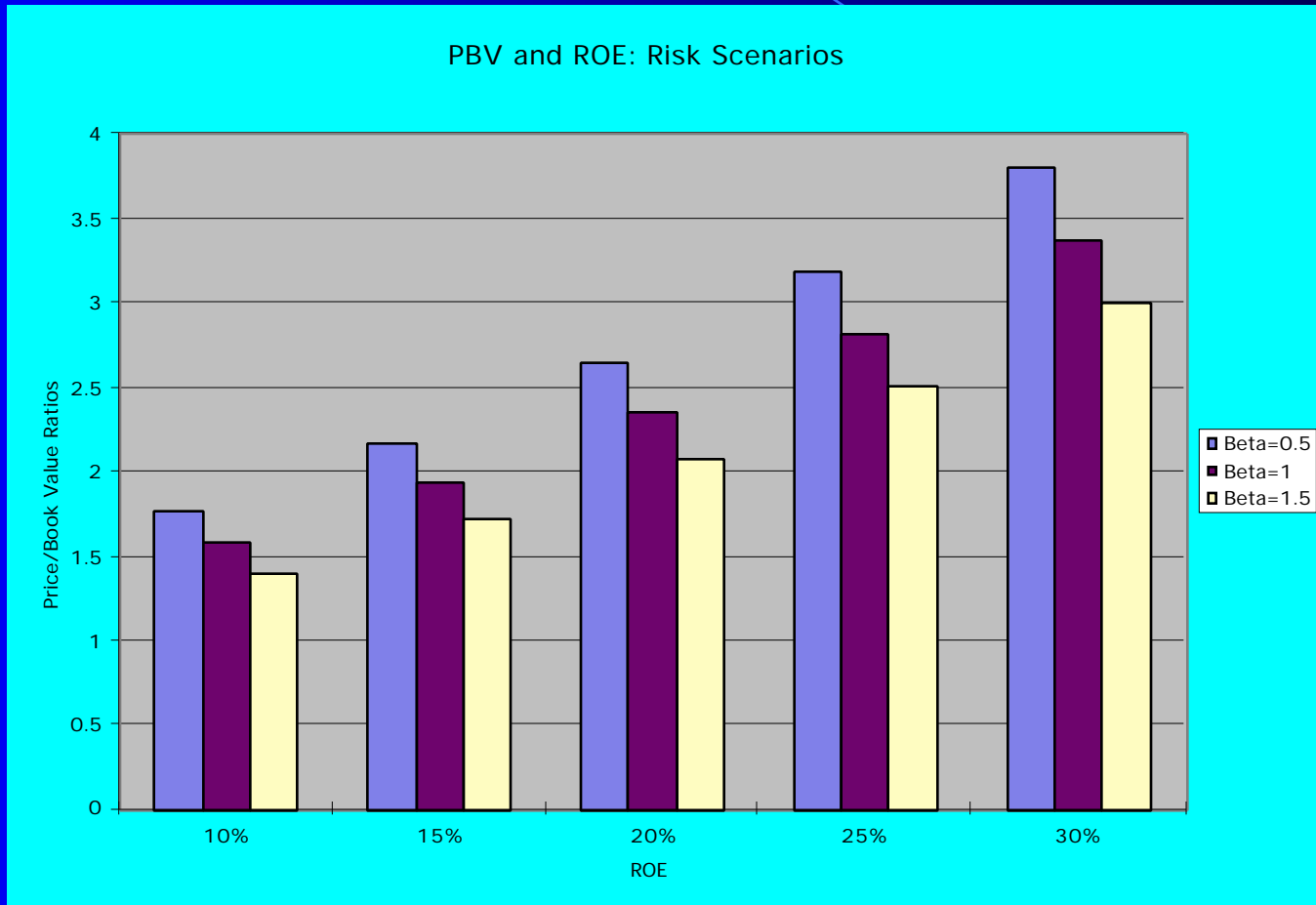
The riskfree rate is 6%.

Estimating Price/Book Value Ratio

- The price/book value ratio for this firm is:

$$PBV = \frac{0.25 * 0.2 * (1.20) * \left(1 - \frac{(1.20)^5}{(1.12875)^5}\right)}{(.12875 - .20)} + \frac{0.15 * 0.6 * (1.20)^5 * (1.06)}{(.115 - .06) (1.12875)^5} = 2.66$$

PBV and ROE: The Key



PBV/ROE: Oil Companies: 1996

Company Name	P/BV	ROE
Total ADR B	0.90	4.10
Giant Industries	1.10	7.20
Royal Dutch Petroleum ADR	1.10	12.30
Tesoro Petroleum	1.10	5.20
Petrobras	1.15	3.37
YPF ADR	1.60	13.40
Ashland	1.70	10.60
Quaker State	1.70	4.40
Coastal	1.80	9.40
Elf Aquitaine ADR	1.90	6.20
Holly	2.00	20.00
Ultramar Diamond Shamrock	2.00	9.90
Witco	2.00	10.40
World Fuel Services	2.00	17.20
Elcor	2.10	10.10
Imperial Oil	2.20	8.60
Repsol ADR	2.20	17.40
Shell Transport & Trading ADR	2.40	10.50
Amoco	2.60	17.30
Phillips Petroleum	2.60	14.70
ENI SpA ADR	2.80	18.30
Mapco	2.80	16.20
Texaco	2.90	15.70
British Petroleum ADR	3.20	19.60
Tosco	3.50	13.70
Average	2.05	11.83

PBV versus ROE regression

- Regressing PBV ratios against ROE for oil companies yields the following regression:

$$\text{PBV} = 0.96 + 9.28 (\text{ROE}) \quad R^2 = 46.67\%$$

- For every 1% increase in ROE, the PBV ratio should increase by 0.0928.

Valuing Pemex

- Assume that you have been asked to value a PEMEX for the Mexican Government; All you know is that it has earned a return on equity of 14% last year. The appropriate P/BV ratio can be estimated in one of two ways –
 - Beta based upon international oil companies = 0.70
 - Cost of Equity = 7.50% + 0.70 (5.50%) = 11.35%
- P/BV Ratio (based upon regression) = $0.96 + 9.28 * 0.14 = 2.26$

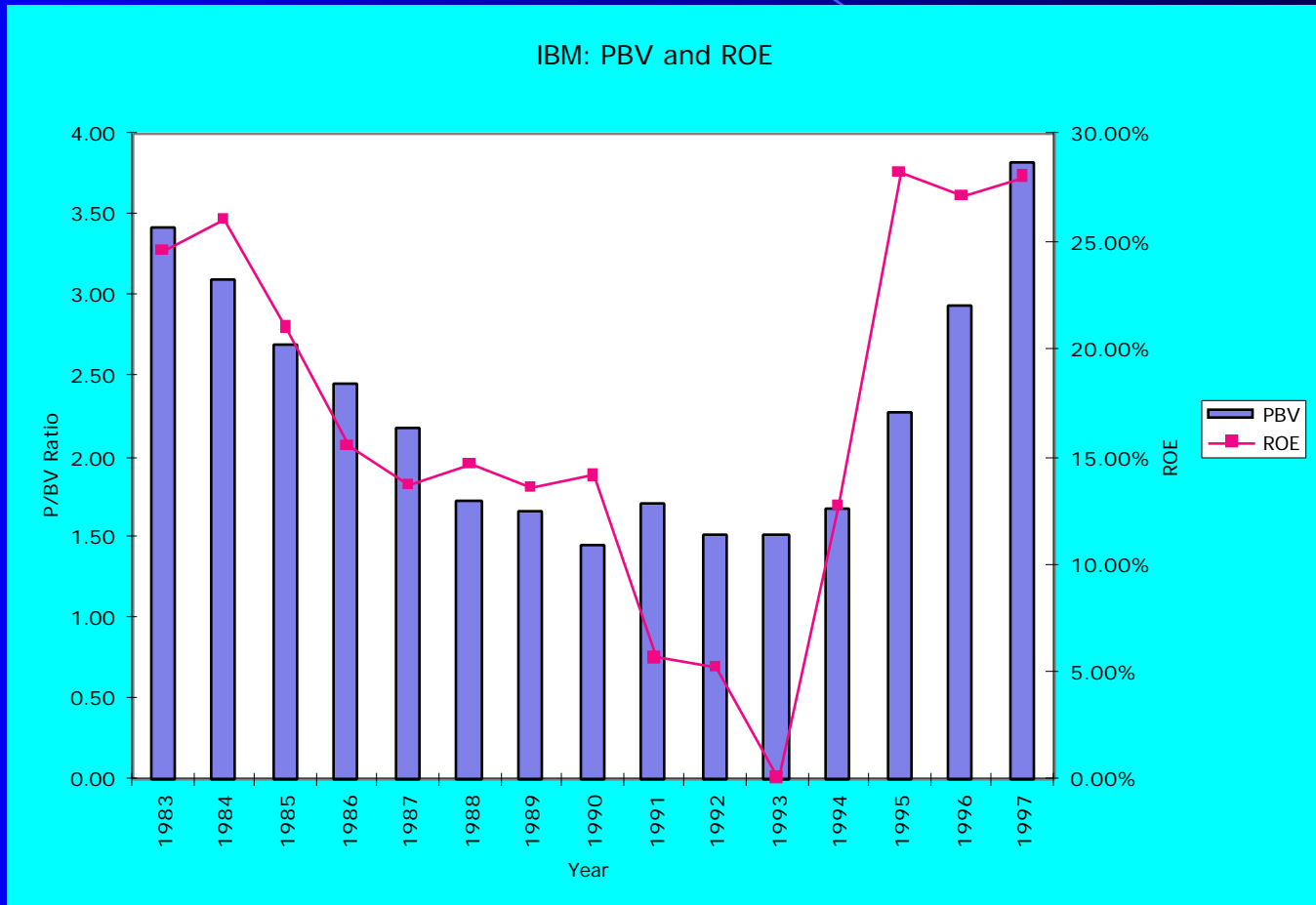
Looking for undervalued securities - PBV Ratios and ROE

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

The Valuation Matrix

MV/BV		
<i>Overvalued</i> Low ROE High MV/BV	High ROE High MV/BV	ROE-r
Low ROE Low MV/BV	<i>Undervalued</i> High ROE Low MV/BV	

IBM: The Rise and Fall



Estimating price-book value ratios from comparables

<i>Year</i>	<i>Regression</i>				<i>R squared</i>
1987	PBV = 0.1841 + .00200	- 0.3940	+ 1.3389 EGR	+ 9.35 ROE	0.8617
1988	PBV = 0.7113 + 0.00007	- 0.5082	+ 0.4605 EGR	+ 6.94 ROE	0.8405
1989	PBV = 0.4119 + 0.0063	- 0.6406	+ 1.0038 EGR	+ 9.55 ROE	0.8851
1990	PBV = 0.8124 + 0.0099	- 0.1857	+ 1.1130 EGR	+ 6.61 ROE	0.8846
1991	PBV = 1.1065 + 0.3505	- 0.6471	+ 1.0087 EGR	+ 10.51 ROE	0.8601

PBV = Price / Book Value Ratio at the end of the year

= Dividend Payout ratio at the end of the year

= Beta of the stock

EGR = Growth rate in earnings over prior five years

ROE = Return on Equity = Net Income / Book Value of Equity

Price/BV Ratio Regression: September 1997

Multiple R .82230
 R Square .67618
 Adjusted R Square .67519
 Standard Error 2.26067

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	4	13873.43418	3468.35855
Residual	1300	6643.79915	5.11061

F = 678.65780 Signif F = .0000

----- Variables in the Equation -----

Variable	B	SE B	Beta	T	Sig T
PROJGR	2.9995	0.6546	.076348	4.582	.0000
PAYOUT	-.002588	.016361	-.002502	-.158	.8743
BETA	1.599903	.237074	.112513	6.749	.0000
ROE	4.823908	.095323	.800078	50.606	.0000
(Constant)	-.062492	.228514		-.273	.7845

Cross Sectional Regression for Brazil in 1997

- Using data obtained from Bloomberg for 137 Brazilian companies, we ran the regression of PBV ratios against returns on equity and obtained the following:

$$\text{PBV} = 1.06 + 2.16 \text{ ROE} \quad R^2 = 15.49\%$$

(11.30) (4.84)

- For instance, the predicted PBV ratios for Aracruz, Telebras, Bradesco and Petrobras would be as follows:

<i>Company</i>	<i>Actual PBV</i>	<i>ROE</i>	<i>Predicted PBV</i>
Aracruz	0.66	15.44%	$1.06 + 2.16(.1544)=1.39$
Bradesco	1.56	16.01%	$1.06 + 2.16(.1601)=1.41$
Petrobras	1.27	3.37%	$1.06 + 2.16 (.0337)=1.13$
Telebras	1.48	9.97%	$1.06 + 2.16(.0997)=1.28$

Cross Sectional Regression for India: November 1997

- Using data from November 1997 for the Indian companies which have GDRs listed on them, and regressing PBV against ROE for these firms yields:

$$\text{PBV} = -1.68 + 24.03 \text{ ROE} \quad (\text{R squared}=51\%)$$

- Reliance, India's largest firm in terms of market value of equity, has a return on equity of 15.86%. Plugging in Reliance's ROE into this equation would yield:

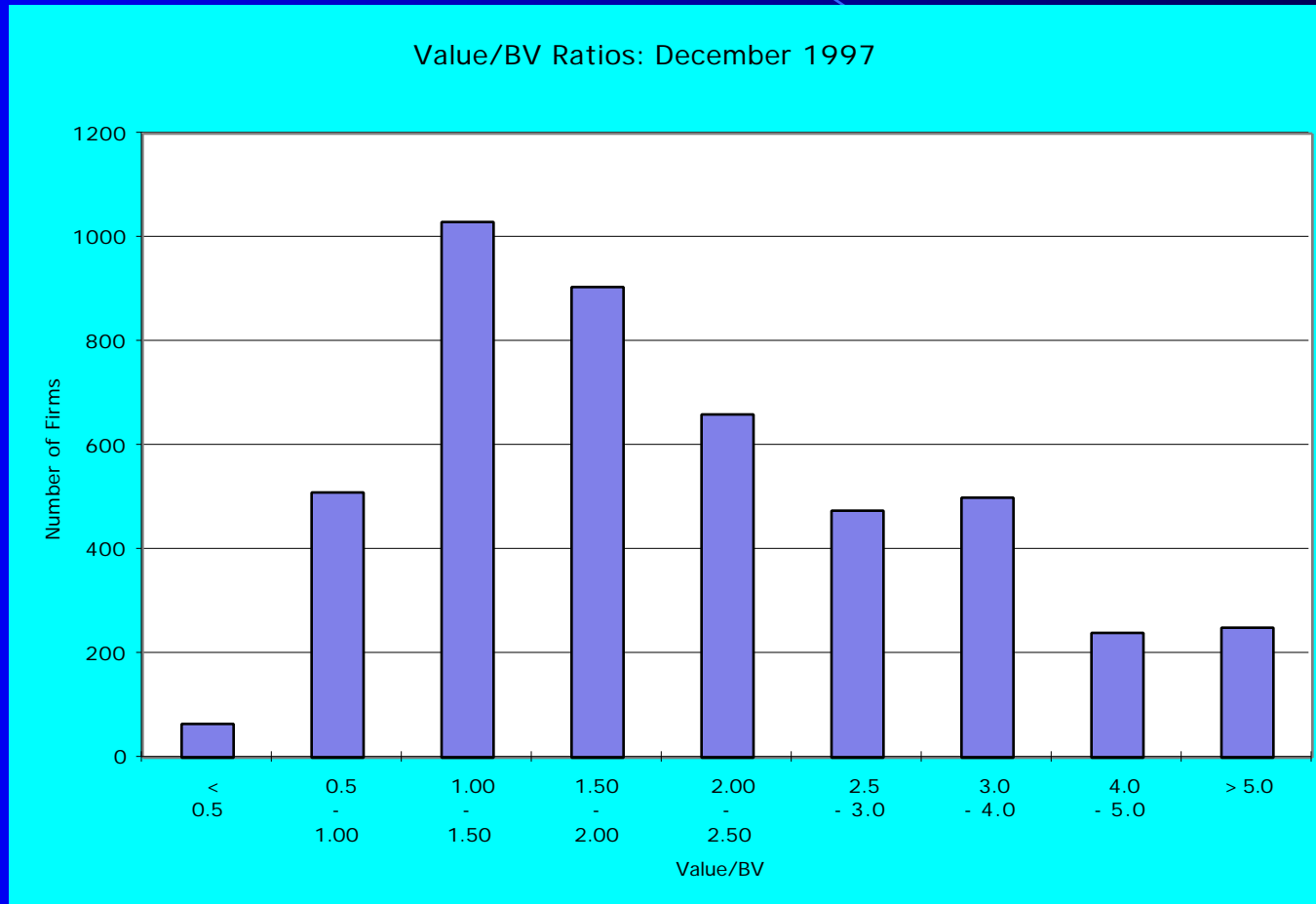
$$\text{Predicted PBV for Reliance} = -1.68 + 24.04 (.1568) = 2.09$$

On a relative basis, Reliance is under valued with a price/book value ratio of 1.80.

Value/Book Value Ratio: Definition

- While the price to book ratio is a equity multiple, both the market value and the book value can be stated in terms of the firm.
- Value/Book Value = $\frac{\text{Market Value of Equity} + \text{Market Value of Debt}}{\text{Book Value of Equity} + \text{Book Value of Debt}}$

Value/Book Ratio: Description



Determinants of Value/Book Ratios

- To see the determinants of the value/book ratio, consider the simple free cash flow to the firm model:

$$V_0 = \frac{\text{FCFF}_1}{\text{WACC} - g}$$

- Dividing both sides by the book value, we get:

$$\frac{V_0}{\text{BV}} = \frac{\text{FCFF}_1/\text{BV}}{\text{WACC} - g}$$

- If we replace, $\text{FCFF} = \text{EBIT}(1-t) - (g/\text{ROC}) \text{EBIT}(1-t)$, we get

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

Value/Book Ratio: An Example

- Consider a stable growth firm with the following characteristics:
 - Return on Capital = 12%
 - Cost of Capital = 10%
 - Expected Growth = 5%
- The value/FCFF ratio for this firm can be estimated as follows:
$$\text{Value/FCFF} = (.12 - .05)/(.10 - .05) = 1.40$$
- The effects of ROC on growth will increase if the firm has a high growth phase, but the basic determinants will remain unchanged.

Value/Book and the Return Spread

