### **Price Earnings Ratio: Definition**

#### **PE = Market Price per Share / Earnings per Share**

- There are a number of variants on the basic PE ratio in use. They are based upon how the price and the earnings are defined.
- Price: is usually the current price
  - is sometimes the average price for the year
  - EPA: earnings per share in most recent financial year
    earnings per share in trailing 12 months (Trailing PE)
    forecaster earnings per share next year (Forward PE)
    forecaster earnings per share in future year

## **PE Ratios: Descriptive Statistics**



### **PE Ratio: Understanding the Fundamentals**

- To understand the fundamentals, start with a basic <u>equity</u> discounted cash flow model.
- With the dividend discount model,



• Dividing both sides by the earnings per share,



• If this had been a FCFE Model,



## **PE Ratio and Fundamentals**

- Proposition: Other things held equal, <u>higher growth firms</u> will have higher PE ratios than lower growth firms.
- Proposition: Other things held equal, <u>higher risk firms</u> will have lower PE ratios than lower risk firms
- Proposition: Other things held equal, firms with lower reinvestment needs will have higher PE ratios than firms with higher reinvestment rates.
- Of course, other things are difficult to hold equal since high growth firms, tend to have risk and high reinvestment rats.

## Using the Fundamental Growth Model to Estimate PE: Stable Dividend Stock

- The fundamental growth model, described earlier, can be used to estimate the PE ratio for a stable growth firm paying dividends=FCFE.
- Deutsche Bank had earnings per share of 46.38 DM in 1994, and paid out 16.50 DM as dividends that year.
- The growth rate in earnings and dividends, in the long term, is expected to be 6%.

The beta for Deutsche Bank is 0.94 and the long term bond rate in Germany is 7.50%. (The premium used for German stocks is 5.5%.)
 Current Dividend Payout Ratio = 16.50/46.38 = 35.58%
 Expected Growth Rate in Earnings and Dividends = 6%
 Cost of Equity =7.50 % + 0.92\*4.5% = 11.64%
 PE Ratio based on fundamentals = 0.3558 \*1.06 / (.1164 -.06) = 6.69

## Using the Fundamental Growth Model to Estimate PE: Stable FCFE Stock

- When a firm pays less in dividends than it has available in FCFE, the model can be modified using FCFE as a percent of earnings instead of the payout ratio.
- Siemens had earnings per share of 32.76 DM and paid dividends per share of 13 DM in 1994. The beta for the stock is 0.93. The ten-year bond rate in Germany was 7.5% and the risk premium for stocks over bonds is assumed to be 4.50%. The company had FCFE in 1994 of 20 DM per share

FCFE Payout Ratio = 61.05 %

**Dividend Payout Ratio** = 39.68%

Expected growth rate in earnings and dividends in long term = 6%

Cost of equity = 7.50% + 0.93 (4.50%) = 11.69%

PE Ratio based on fundamentals= 0.6105 \* 1.06 / (.1169 - .06) = 11.37Siemens was selling at a price-earnings multiple of 16.68 in July 1993.

## Using the Fundamental Model to Estimate PE For a High Growth Firm

• The price-earnings 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:



- For a firm that does not pay what it can afford to in dividends, substitute FCFE/Earnings for the payout ratio.
- Dividing both sides by the earnings per share:



### **Expanding the Model**

- In this model, the PE ratio for a high growth firm is a function of growth, risk and payout, exactly the same variables that it was a function of for the stable growth firm.
- The only difference is that these inputs have to be estimated for two phases the high growth phase and the stable growth phase.
- Expanding to more than two phases, say the three stage model, will mean that risk, growth and cash flow patterns in each stage.

## A Simple Example

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

Variable	High Growth Phase	Stable Growth Phase
Expected Growth Rate	25%	8%
Payout Ratio	20%	50%
Beta	1.00	1.00

• Riskfree rate = T.Bond Rate = 6%

• Required rate of return = 6% + 1(5.5%) = 11.5%

DE	0.2 * (1.25) *	$1 - \frac{(1.25)^5}{(1.115)^5}$	$0.5 * (1.25)^5 * (1.08)$	29.75
FE -	(.115 -	.25)	+ $(.11508)(1.115)^5$	- 20.75

## PE and Growth: Firm grows at x% for 5 years, 8% thereafter



# PE Ratios and Length of High Growth: 25% growth for n years; 8% thereafter



## PE and Risk: Effects of Changing Betas on PE Ratio:

Firm with x% growth for 5 years; 8% thereafter

PE Ratios and Beta: Growth Scenarios



## PE and Payout

PE Ratios and Payour Ratios: Growth Scenarios



## **Country PE ratios**



## **Comparisons across countries**

- In December 1997, a market strategist is making the argument that Thailand and Indonesia are cheap relative to Taiwan, because they have much lower PE ratios. Would you agree?
- □ Yes
- No
- What are some of the factors that may cause one market's PE ratios to be lower than another market's PE?

## A Comparison across countries

Country	PE Ratio	Interest	rate	Exp. Growth Rate
		ST	LT	in GDP-1993
Australia	20.1	5.65%	8.67%	3.0%
Britain	18.9	6.19%	8.54%	1.1%
Canada	17.2	6.36%	8.69%	2.7%
France	14.9	12.31%	7.94%	0.6%
Germany	14.4	8.45%	7.01%	-0.8%
Japan	38.2	3.46%	4.28%	1.7%
Netherlands	12.8	9.05%	8.55%	0.5%
Switzerland	15.2	5.75%	5.34%	0.4%
U.S.	24.0	3.21%	7.25%	2.9%

 A naive comparison of PE ratios suggests that Japanese stocks, with a PE ratio of 38.2, are overvalued, while Dutch stocks, with a PE ratio of 12.8, are undervalued

## **Correlations and Regression of PE Ratios**

#### • Correlations

- Correlation between PE ratio and short term interest rates = -0.883
- Correlation between PE ratio and long term interest rates = -0.183
- Correlation between PE ratio and expected growth rate in GDP = 0.767
- Regression Results
  - PE Ratio = 41.85 0.20 Short term rate 3.44 Long Term rate + 3.21 Growth in GDP

## Predicted PE Ratios

Country	Actual PE	Predicted PE	Over/Undervalued by
Australia	20.1	20.56	-0.46
Britain	18.9	14.80	4.10
Canada	17.2	19.38	-2.18
France	14.9	14.04	0.86
Germany	14.4	13.51	0.89
Japan	38.2	31.91	6.29
Netherlands	12.8	12.27	0.53
Switzerland	15.2	23.64	-8.44
U.S.	24	25.60	-1.60

## An Example with Emerging Markets

Country Risk	PE Ratio	Interest Rates	GDP Nom Growth	Country
Peru	63	15.00%	22.00%	20
South Korea	38	16.55%	17.70%	20
Malaysia	36	5.67%	12.10%	30
Phillipines	34	9.06%	14.10%	55
India	33	11.48%	16.20%	45
Pakistan	32	12.50%	16.50%	50
Turkey	30	70.00%	79.00%	55
Thailand	30	12.75%	13.20%	30
Chile	28	13.35%	12.40%	25
Brazil	26	80.00%	75.20%	60
Argentina	24	12.70%	11.00%	55
Indonesia	22	16.00%	15.20%	40
Venezuela	20	15.00%	15.70%	75
Mexico	19	50.50%	44.00%	70
Hong Kong	20	6.64%	10.60%	15
Singapore	35	3.25%	13.60%	5

### **Regression Results**

- The regression of PE ratios on these variables provides the following
  - PE = 33.52 103.5 Interest Rates
    - + 103.85 Nominal Growth in GNP
    - 0.143 Country Risk

## Predicted PE Ratios

Country	PE Ratio	Predicted PE	Over or
Peru	63	37.98	65.88%
South Korea	38	31.91	19.09%
Malaysia	36	35.92	0.21%
Phillipines	34	30.92	9.97%
India	33	32.02	3.05%
Pakistan	32	30.56	4.70%
Turkey	30	35.24	-14.88%
Thailand	30	29.74	0.88%
Chile	28	29.00	-3.46%
Brazil	26	25.83	0.65%
Argentina	24	23.93	0.29%
Indonesia	22	27.02	-18.59%
Venezuela	20	23.57	-15.15%
Mexico	19	16.93	12.20%
Hong Kong	20	35.51	-43.67%
Singapore	35	43.56	-19.65%

or Under 8% 9% % % % % 88% % 5% % % 59% 15% 0% 57%

## Comparisons of PE across time



## Is low (high) PE cheap (expensive)?

- A market strategist argues that stocks are over priced because the PE ratio today is too high relative to the average PE ratio across time. Do you agree?
- Yes
- No
- If you do not agree, what factors might explain the higer PE ratio today?

## **E/P Ratios**, **T.Bond Rates** and **Term Structure**



#### **Regression Results**

- There is a strong positive relationship between E/P ratios and T.Bond rates, as evidenced by the correlation of 0.68 between the two variables.
- In addition, there is evidence that the term structure also affects the PE ratio.
- In the following regression, we regress E/P ratios against the level of T.Bond rates and a term structure variable (T.Bond T.Bill rate)
  E/P = 2.82% + 0.7494 T.Bond Rate 0.8471 (T.Bond Rate-T.Bill Rate) (3.17) (6.78) (-3.65)
  R squared = 60.67%

## Estimate the E/P Ratio Today

- T. Bond Rate =
- T.Bond Rate T.Bill Rate =
- Expected E/P Ratio =
- Expected PE Ratio =

## Comparing PE ratios across firms

Company Name		Price	EPS	PE Ratio	Growth Rate
Adobe Systems	\$	42.13	\$ 2.04	20.65	19.50%
Autodesk Inc.	\$	40.00	\$ 0.95	42.11	17.00%
Automatic Data Proc.	\$	56.06	\$ 1.83	30.64	14.00%
BARRA Inc.	\$	26.75	\$ 1.05	25.55	29.50%
BMC Software	\$	68.50	\$ 1.60	42.81	23.50%
BancTec Inc.	\$	24.75	\$ 1.76	14.06	18.50%
Broderbund Software	\$	30.75	\$ 1.67	18.41	6.50%
Ceridian Corp.	\$	44.63	\$ 2.25	19.83	10.50%
Comdisco Inc.	\$	31.31	\$ 1.33	23.49	17.00%
Computer Associates	\$	52.56	\$ 1.69	31.05	20.00%
Computer Sciences	\$	86.31	\$ 2.91	29.66	16.00%
Corel Corp.	\$	2.19	\$ (0.16)	NA	4.50%
Electronic Data Sys.	\$	40.50	\$ 2.07	19.57	12.00%
First Data Corp.	\$	28.88	\$ 1.37	21.08	15.50%
Fiserv Inc.	\$	48.19	\$ 1.34	35.96	19.50%
Gartner Group 'A'	\$	31.56	\$ 0.51	61.89	36.50%
Informix Corp.	\$	6.16	\$ 0.63	9.77	8.00%
Mentor Graphics	\$	9.56	\$ 0.52	18.39	9.50%
Microsoft Corp.	\$	144.69	\$ 2.63	55.01	27.00%
National Data Corp.	\$	34.63	\$ 1.38	25.09	26.50%
Network Assoc.	\$	49.75	\$ 0.92	54.08	52.00%
Novell Inc.	\$	8.34	\$ 0.31	26.92	6.00%
Oracle Corp.	\$	30.25	\$ 0.84	36.01	25.50%
Parametric Technology	\$	48.81	\$ 1.19	41.02	31.50%
Paychex Inc.	\$	41.44	\$ 0.70	59.20	27.00%
PeopleSoft	\$	68.38	\$ 0.46	148.64	43.00%
Policy Mgmt. Sys.	\$	67.44	\$ 2.37	28.45	20.50%
Sterling Commerce	\$	35.75	\$ 0.99	36.11	24.50%
Sterling Software	\$	39.13	\$ 1.80	21.74	9.50%
SunGard Data Sys.	\$	27.69	\$ 0.80	34.83	19.00%
Sybase Inc.	\$	13.50	\$ (0.40)	NA	29.50%
Symantec Corp.	\$	25.94	\$ 0.78	33.25	33.00%
System Software	\$	14.50	\$ (0.76)	NA	45.50%
A	vera	ae		35.51	21.74%

## A Question

You are reading an equity research report on Informix, and the analyst claims that the stock is under valued because it has a PE ratio of 9.77 which is much lower than the average for the sector., which is 35.51. Would you agree?

- □ Yes
- No
- Why or why not?

#### Using comparable firms- Pros and Cons

• The most common approach to estimating the PE ratio for a firm is

- to choose a group of comparable firms,
- to calculate the average PE ratio for this group and
- to subjectively adjust this average for differences between the firm being valued and the comparable firms.
- Problems with this approach.
  - 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 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.
  - 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.

## Using the entire crosssection: A regression approach

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

#### Methodology for the Regressions

- The COMPUSTAT data base was used to extract information on priceearnings ratios, 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 earnings were eliminated from the sample
- The firms were first classified into industry groups (using the first two digits of SIC codes), and the regression of PE on the independent variable yielded the following for each year:

#### **Regression Results**

YearRegressionR squared1987 PE = 7.1839 + 13.05 PAYOUT - 0.6259 BETA + 6.5659 EGR0.9287<math>1988 PE = 2.5848 + 29.91 PAYOUT - 4.5157 BETA + 19.9143 EGR0.9465<math>1989 PE = 4.6122 + 59.74 PAYOUT - 0.7546 BETA + 9.0072 EGR0.5613<math>1990 PE = 3.5955 + 10.88 PAYOUT - 0.2801 BETA + 5.4573 EGR0.3497<math>1991 PE = 2.7711 + 22.89 PAYOUT - 0.1326 BETA + 13.8653 EGR0.3217where,<math>0.3217

PE = Price-Earnings ratio at the end of the year PAYOUT = Dividend Payout ratio at the end of the year BETA = Beta of the stock, using returns from prior five years EGR = Earnings growth rate over the previous five years

## PE Ratio Regression: September 1997

Multiple R		. 36951
R Square		. 13654
Adjusted R	Square	. 13461
Standard E	rror	7.17648

Analysis of Variance

	DF
<b>Regressi</b> on	3
Resi dual	1347

Sum of Squares 10969.66594 69372.95854

Mean Square 3656. 55531 51. 50183

F = 70.99856 Signif F = .0000

Variables in the Equation -----

Vari abl e	В	SE B	Beta	Т	Sig T
Growth Rate	25. 3159	2. 2005	. 312415	11. 504	. 0000
PAYOUT	1.554556	. 556813	. 076777	2. 792	. 0053
BETA	4. 313746	. 785707	. 153493	5.490	. 0000
(Constant)	11. 269895	. 852988		13. 212	. 0000

#### Problems with the regression methodology

- The basis regression assumes a linear relationship between PE ratios and the financial proxies, and that might not be appropriate.
- The independent variables are correlated with each other. For example, high growth firms tend to have high risk. This multi-collinearity makes the coefficients of the regressions unreliable and may explain the large changes in these coefficients from period to period.
- The basic relationship between PE ratios and financial variables itself might not be stable, and if it shifts from year to year, the predictions from the model may not be reliable.

## Investment Strategies that compare PE to the expected growth rate

- If we assume that all firms within a sector have similar growth rates and risk, a strategy of picking the lowest PE ratio stock in each sector will yield undervalued stocks.
- Portfolio managers and analysts sometimes compare PE ratios to the expected growth rate to identify under and overvalued stocks.
  - In the simplest form of this approach, firms with PE ratios less than their expected growth rate are viewed as undervalued.
  - In its more general form, the ratio of PE ratio to growth is used as a measure of relative value.