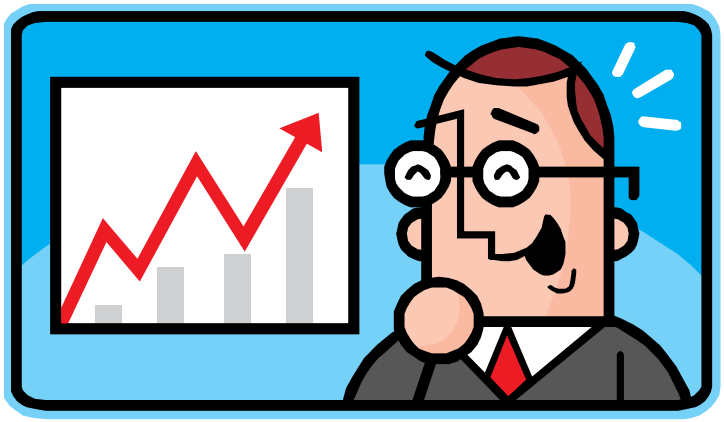
Lecture 7 Valuing Stocks



1 Dividend Discount Model (股利贴现模型)

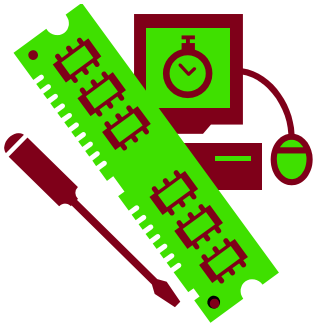
A stock provides two kinds of cash flows. First, most stocks pay dividends on a regular basis. Second, the stockholder receives the sale price when she sells the stock.

One time period case :

$$P_0 = \frac{Div_1}{1+r} + \frac{P_1}{1+r}$$

Div_1 is the dividend paid at date1 and P_1 is the sale price at the end of date 1. P_0 is the PV of the common stock investment. r is the discount rate of the stock.

$$r = \frac{Div_1}{P_0} + \frac{P_1 - P_0}{P_0}$$



Stock Return=Dividend Yield + Capital Gain

(股利收益率) (资本利得收益率)

This says that the return on stock (i.e., the stock's discount rate) equals the sum of the dividend yield plus the rate of capital gain.

But where does P_1 come from?

$$P_1 = \frac{Div_2}{1+r} + \frac{P_2}{1+r} \quad \Rightarrow \quad P_0 = \frac{Div_1}{1+r} + \frac{Div_2}{(1+r)^2} + \frac{P_2}{(1+r)^2}$$

$$\Downarrow$$

$$P_0 = \frac{Div_1}{1+r} + \frac{Div_2}{(1+r)^2} + \frac{Div_2}{(1+r)^3} + \cdots = \sum_{t=1}^{\infty} \frac{Div_t}{(1+r)^t}$$

Thus the value of a firm's common stock to the investor is equal to the present value of all the expected future dividends.

(1) Zero Growth

The dividend payment is constant forever.

$$Div_1 = Div_2 = Div_3 = ... = Div$$

The value of a stock with a constant dividend is:

$$P_0 = \frac{Div_1}{1+r} + \frac{Div_2}{(1+r)^2} + \frac{Div_3}{(1+r)^3} + ...$$

$$= \frac{Div_1}{r}$$

(2) Constant Growth
(Dividend Growth Model)

Dividends grow at rate g.

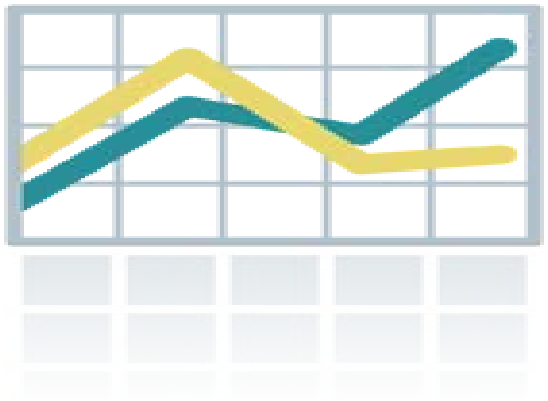
The value of a common stock with dividends growing at a constant rate g is:

$$P_0 = \frac{Div_1}{1+r} + \frac{Div_1(1+g)}{(1+r)^2} + \frac{Div_1(1+g)^2}{(1+r)^3} + \ldots$$

$$= \frac{Div_1}{r-g}$$

(3) Differential Growth

The dividend is experiencing different growth rate.



Example 1:

The dividends of Firm ABC are expected to grow at 20% per year for the next 7 years. After that, the rate of growth in dividends will stabilize at 10% per year.

Given that the discount rate of the firm is 25%, and the dividend it just paid was $10. Work out its current price.

2 NPVGO Model

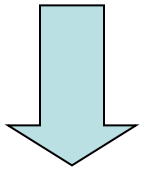
2.1 Growth rate and Discount rate

- Assume initially the earnings are constant each year, unless new investment opportunities are undertaken.
- If a new investment is made, it must be the case some earnings are not paid out as dividends, but are retained.
- Retained earnings are invested as capital to generate future earnings.
- Assume that the only source of financing is retained earnings.

First, where does growth rate come from?

$$earnings\ next\ year = earnings\ this\ year + increase\ in\ earnings$$

$$earnings\ next\ year = earnings\ this\ year +$$
$$retained\ earnings\ this\ year \times return\ on\ retained\ earnings$$



$$g = retention\ ratio \times return\ on\ retained\ earnings$$

$$1 - retention\ ratio\ (plowback\ ratio) = payout\ ratio$$

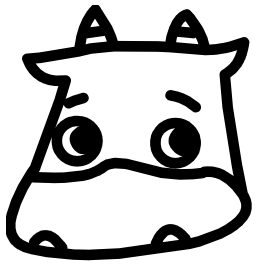
$\frac{retained\ earnings\ this\ year}{earnings\ this\ year}$ is called retention ratio or the plowback ratio. $return\ on\ retained\ earnings$ can also be referred to as return on equity or ROE.

Second, where does the discount rate come from?

$$r = \frac{Div_1}{P_0} + g$$

Thus, the discount rate can be broken into two parts. $\frac{Div_1}{P_0}$ places the dividend return on a percentage basis, it is called dividend yield. The second term g is the growth rate of dividends.

2.2 The NPVGO Model



Case 1 Cash Cow (现金牛)

Imagine a company with a level stream of earnings per share in perpetuity. The company pays all of these earnings out to stockholders as dividends. Then

$$EPS = DPS$$

The value of a share of stock when firm acts as a cash cow is

$$P_0 = \frac{EPS}{r} = \frac{DPS}{r}$$

Case 2: The firm with growth opportunities

The net present value of the project as of date 0 is NPVGO, which stands for the net present value of the growth opportunity.

Because the per share value of the project is added to the original stock price, the stock price after firm commits to new project is

$$P_0 = \frac{EPS}{r} + NPVGO$$

Example 2:

A firm generates a constant stream of earnings per share of $5 currently, if no new investment is taken.

Suppose the management will retain 40% of its earnings at Date 1. The one-time new investment will earn a return of 20% on the retained earnings per year forever. The discount rate (r) is 12%.

What is the price of stock before and after undertaking the new investment?

What is the stock price if this company's return on retained earnings can only be 12%? And why?

3 The relation between dividend discount model and the NPVGO model

Example 3:

Firm A has EPS of $10 at the end of the first year, a dividend payout ratio of 40 percent, a discount rate of 16 percent, and a return on its retained earnings of 20 percent. Because the firm retains some of its earnings each year, it is selecting growth opportunities each year.

We wish to calculate the price per share using both the dividend discount model and the NPVGO model.

Real World Example:

1) It is 2001 and you are attempting to value AT&T equity. The long distance market is mature and new competition makes growth difficult. In fact, AT&T has experienced little growth over the last few years, which you believe will continue.

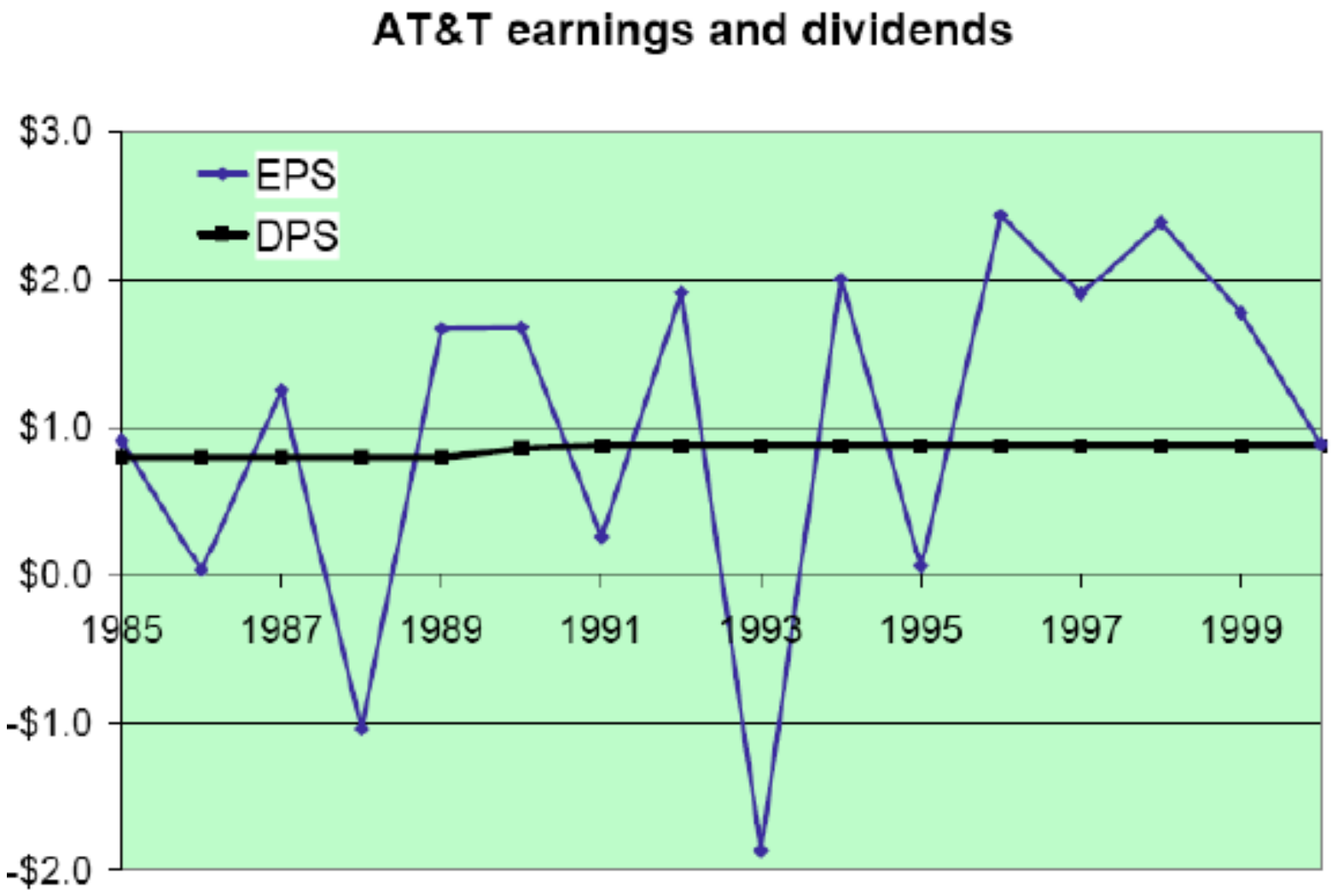
Dividends

Year	1996	1997	1998	1999
DPS	0.88	0.88	0.88	0.88

No Growth Formula (actual price=$17.25)

$$If\ r = 7\%,\quad price = \frac{0.88}{0.07} = \$12.57$$

$$If\ r = 5\%,\quad price = \frac{0.88}{0.05} = \$17.60$$


AT&T earnings and dividends
$3.0
$2.0
$1.0
$0.0
-$1.0
-$2.0
EPS
DPS
1985
1987
1989
1991
1993
1995
1997
1999

2) By 2003, AT&T's situation had changed. Demand for long distance and broadland is expanding. AT&T decides to reinvest half its earnings, equal to $1.50 per share in 2002. Analysts forecast that AT&T would earn an ROE of 15% on its investments.

If investors required a 10% rate of return, what is the value of AT&T's stock at the end of 2002?

What information do we need?

$$ROE = 15\% \quad plowback\ ratio = 50\% \quad EPS_{2002} = 1.50$$

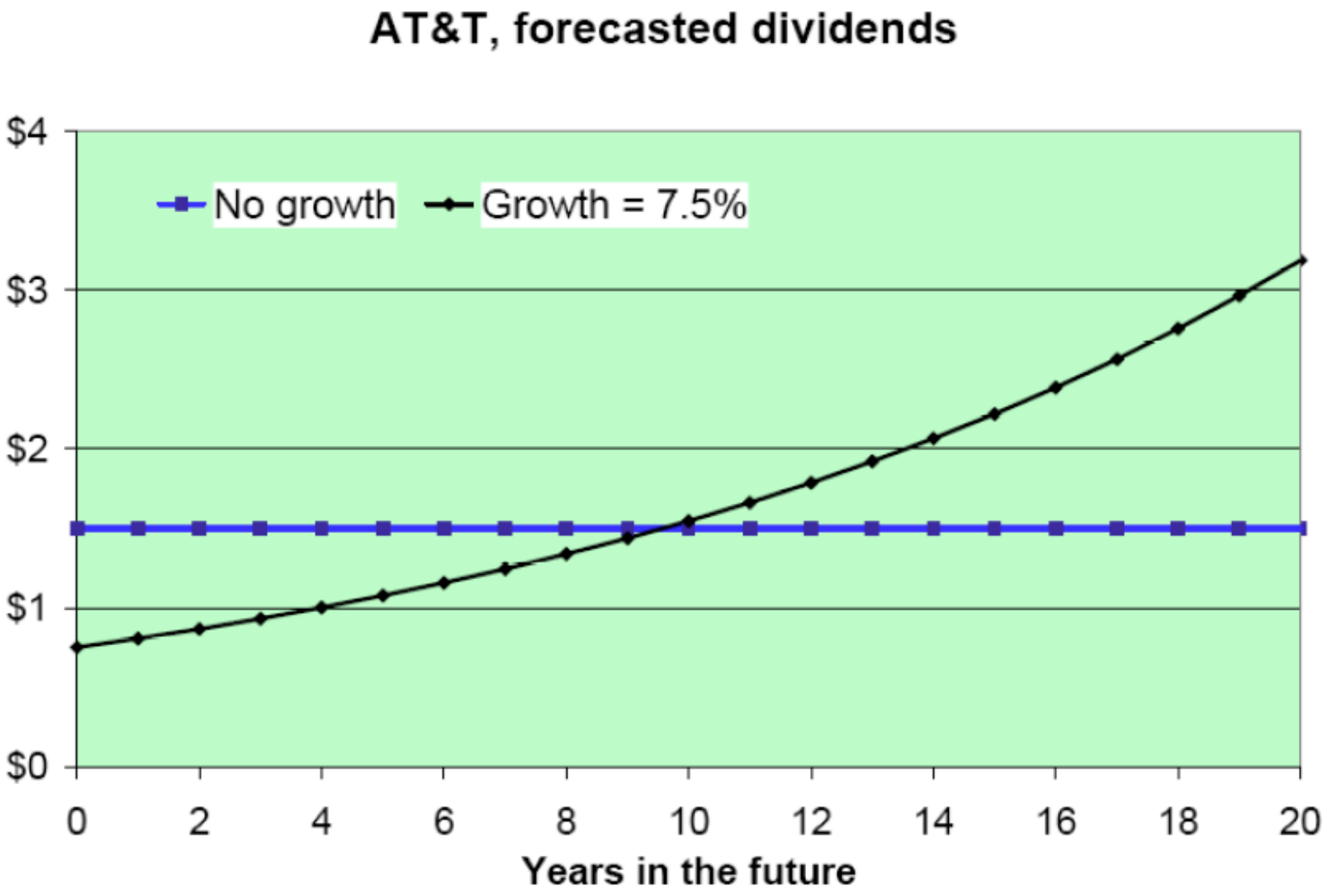
$$\Rightarrow g = 7.5\% \quad Div_{2002} = 0.75$$

$$Div_{2003} = 0.75 \times 1.075 = 0.806$$

$$price = \frac{\$0.806}{0.10 - 0.075} = \$32.24$$

Growth opportunities increase AT&T's stock price from $15.00 to $32.24, or 215%.

AT&T	No growth	Growth
EPS	$1.50	$1.50
DIV	$1.50	$0.75
Plowback	0%	50%
Growth	0%	7.5%
Price	$15.00	$32.24


AT&T, forecasted dividends
$4
$3
$2
$1
$0
No growth
Growth = 7.5%
0
2
4
6
8
10
12
14
16
18
20
Years in the future

3) Suppose that AT&T could earn only 6% ROE on its investments. What would be AT&T's stock price?

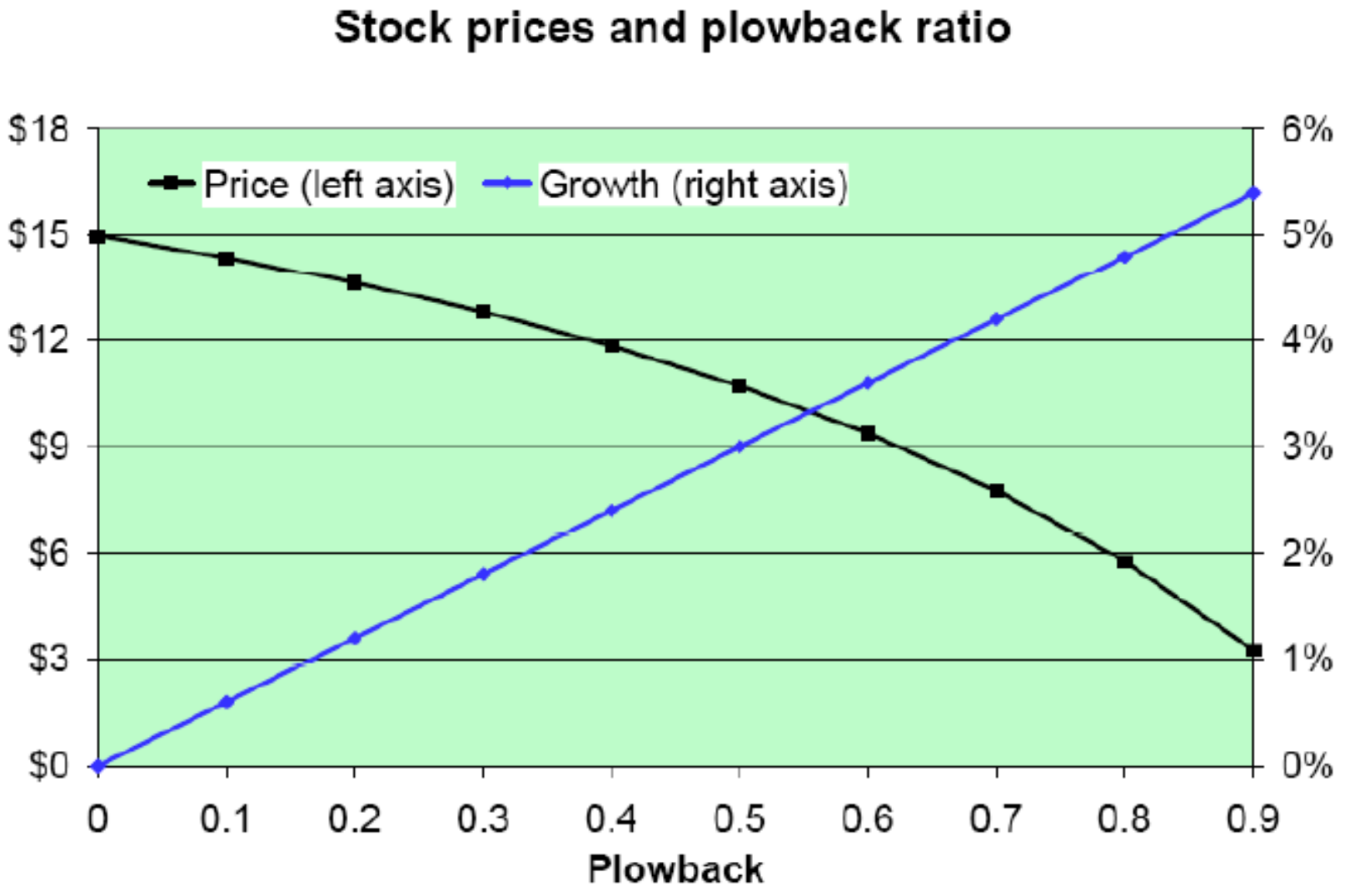
$$ROE = 6\% \quad plowback\ ratio = 50\% \quad EPS_{2002} = 1.50$$

$$\Rightarrow g = 3\% \quad Div_{2002} = 0.75$$

$$Div_{2003} = 0.75 \times 1.03 = 0.773$$

$$price = \frac{\$0.773}{0.10 - 0.03} = \$11.04$$

Growth drops the stock price from \$15.00 to \$11.04. Growth is not equal to growth opportunities!


Stock prices and plowback ratio
Price (left axis)
Growth (right axis)
$18
$15
$12
$9
$6
$3
$0
6%
5%
4%
3%
2%
1%
0%
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Plowback

4 Stock Market Reporting

In recent years, stock price quotes and related information have increasingly moved from traditional print media, such as *The Wall Street Journal*, to various websites.

Yahoo! Finance (finance. yahoo.com) is a good example.

We request a stock quoted on wholesale club Costco, which is listed on the NASDAQ. Here is a portion of what we found.

Costco Wholesale Corporation (COST) - NasdaqGS ★ Watchlist

Add to Portfolio | Like 214

138.76 ↓2.65(1.87%) 2:23PM EST - Nasdaq Real Time Price

Prev Close:	141.41	Day's Range:	138.34 - 141.36
Open:	139.38	52wk Range:	109.50 - 146.82
Bid:	138.84 x 100	Volume:	2,263,661
Ask:	138.86 x 200	Avg Vol (3m):	2,066,120
1y Target Est:	144.27	Market Cap:	60.88B
Beta:	0.82	P/E (ttm):	29.83
Next Earnings Date:	5-Mar-15	EPS (ttm):	4.65
		Div & Yield:	1.42 (1.00%)

Example 4:

Lewin Skis Inc. (today) expects to earn $4 per share for each of the future operating periods beginning at time 1 if the firm makes no new investments and returns the earnings as dividends to the shareholders.

However, Clint Williams, president and CEO, has discovered an opportunity to retain (and invest) 25 percent of the earnings beginning three years from today (starting at time 3). This opportunity to invest will continue for each period indefinitely. He expects to earn 40 percent per year on this new equity investment (ROE of 40), the return beginning one year after each investment is made. The firm's equity discount rate is 14 percent throughout.

A What is the price per share (now at time 0) of Lewin Skis Inc. stock without making the new investment?

B If the new investment is expected to be made, per the preceding information, what would the value of the stock per share be now (at time 0)?

C What is the expected capital gain yield for the second period, assuming the proposed investment is made? What is the expected capital gain yield for the second period if the proposed investment is not made?

D What is the expected dividend yield for the second period if the new investment is made? What is the expected dividend yield for the second period if the new investment is not made?