Firm valuation (1)

Class 6
Financial Management, 15.414

Today

Firm valuation

- Dividend discount model
- Cashflows, profitability, and growth

Reading

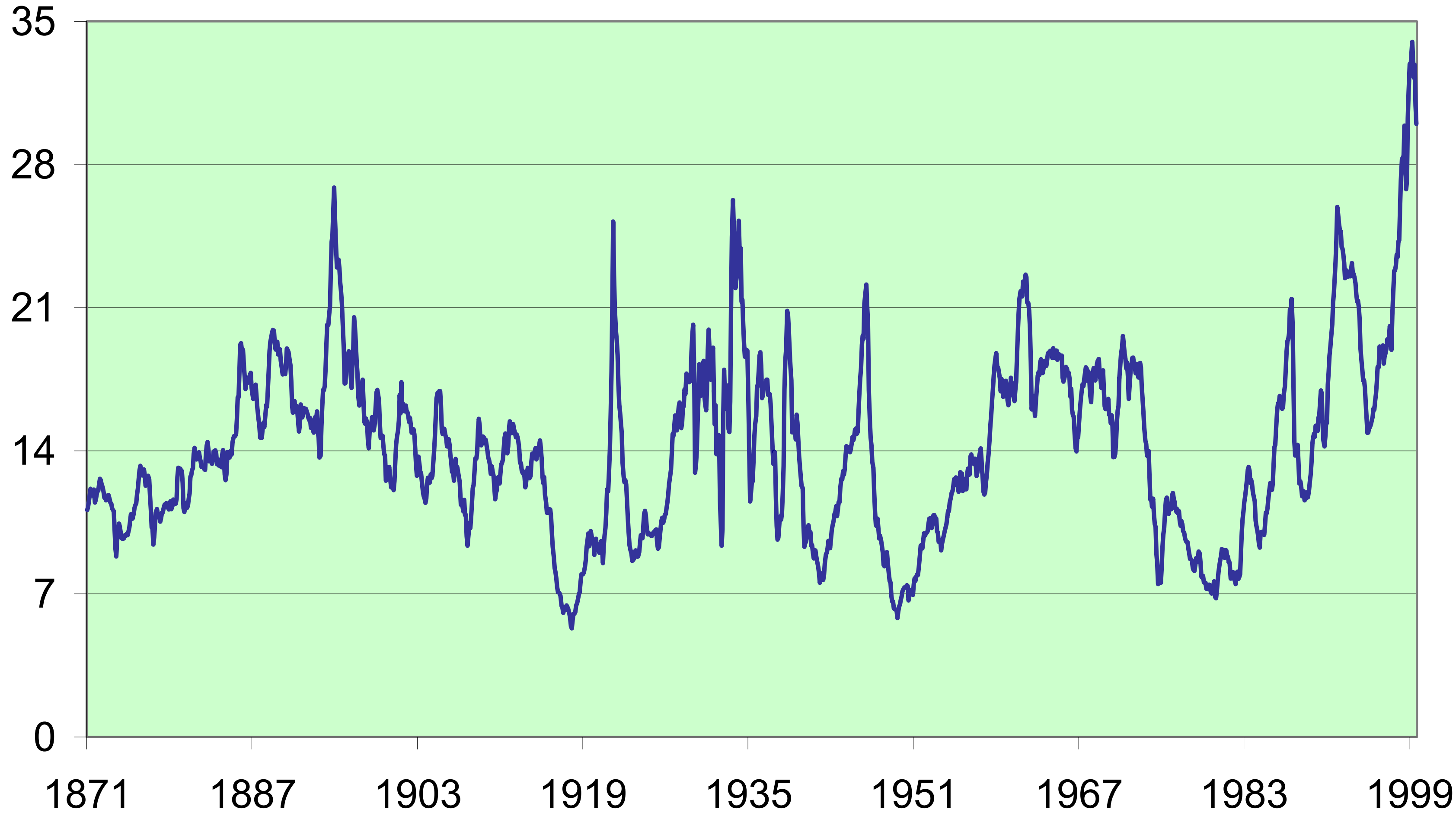
- Brealey and Myers, Chapter 4

Firm valuation

- The WSJ reports that FleetBoston has a DY of 4.6% and a P/E ratio of 16, IBM has a DY of 0.8% and a P/E ratio of 27, and Intel has a DY of 0.3% and a P/E ratio of 46. What explains the differences? What do the financial ratios tell us about the prospects of each firm?

- Your firm has the opportunity to acquire a smaller competitor. You forecast that the target will earn $78 million this year, $90 million next year, and $98 million in the following year. The target reinvests 75% of its earnings and long-term growth is expected to be 6% for the foreseeable future. Is the growth rate adequate given its payout policy? How much would you be willing to pay for the firm?

S&P price-earnings ratio, 1871 – 1999



Firm valuation

Similar to projects

- **DCF analysis**

  Forecast cashflows (inflation, working capital, taxes, …)

  Discount at the opportunity cost of capital

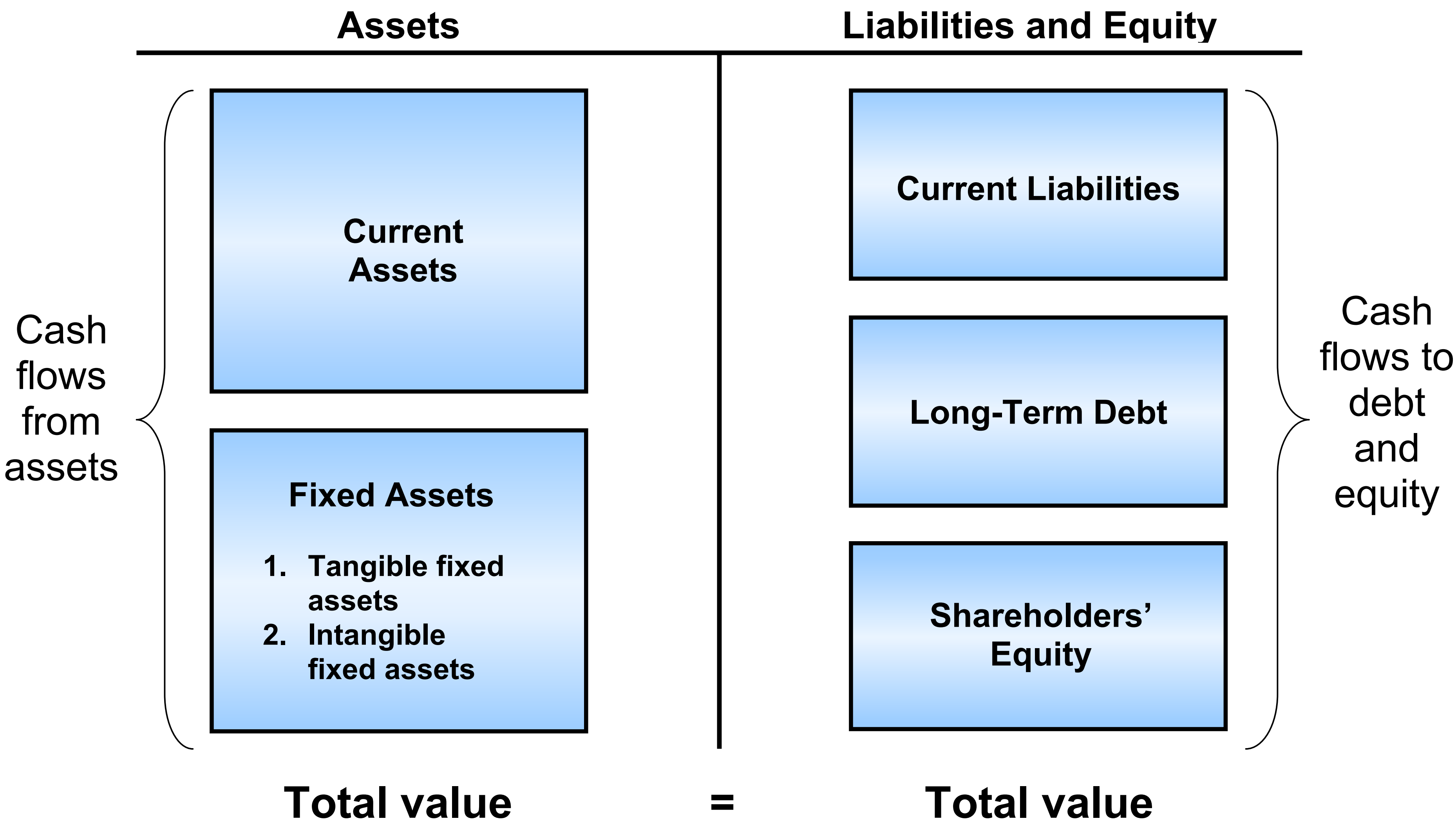
- **Additional issues**

  Assets or equity value?

  Is growth sustainable? How does growth affect cashflow?

  Firms have no end date. Do we have to forecast cashflows forever?

Balance sheet view of the firm



Approach 1

Asset value

$$\text{PV of assets} = \frac{FCF_1}{1+r} + \frac{FCF_2}{(1+r)^2} + \ldots + \frac{FCF_H}{(1+r)^H} + \frac{\text{Term. value}}{(1+r)^H}$$

- **Free cashflow**
  Cash generated by the assets after all reinvestment
  FCF = EBIT $(1 - \tau)$ + depreciation – ΔNWC – CAPX

- **Terminal value**
  Firm value at the end of the forecast horizon

- **Equity**
  Equity value = Assets – Debt

Approach 2

Equity value

$$\text{PV of equity} = \frac{\text{Div}_1}{1+r} + \frac{\text{Div}_2}{(1+r)^2} + \ldots + \frac{\text{Div}_H}{(1+r)^H} + \frac{\text{Term. value}}{(1+r)^H}$$

- **Equity is a claim to future dividends**
  Div_t = expected dividend

- **Terminal value**
  Equity value at the end of the forecast horizon

- **Assets**
  Asset value = Equity + Debt

- **Most useful if payout policy is stable**
  Not for high growth firms

Approach 3

Equity value

PV of equity = stock price (Look in the WSJ!)

Why does this approach make sense?

If the market is efficient, stock price is the best estimate of value

Why shouldn't we always use it?

Private companies (no stock price)

Private information

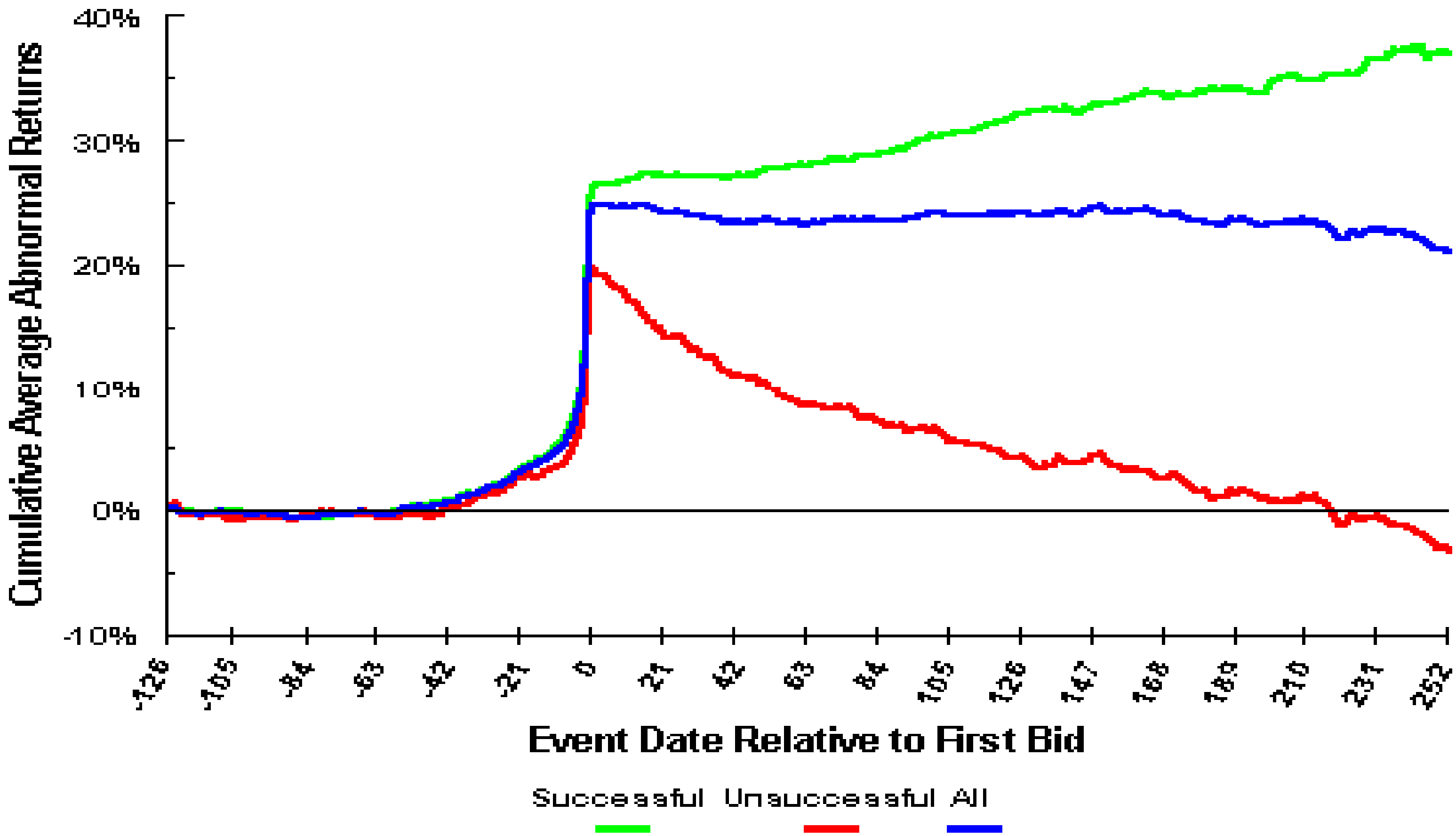
Acquisitions create value not yet reflected in stock prices (?)

Sometimes the market gets it wrong

But, typically not a bad benchmark

Takeover announcements

Stock price of target firm



Capital gains vs. dividends

What about capital gains?

Buy stock today $\Rightarrow$ future cashflow of $Div_1 + P_1$

- $P_0 = \dfrac{E[Div_1] + E[P_1]}{1+r}$

- $P_1 = \dfrac{E[Div_2] + E[P_2]}{1+r}$

Substitute P_1 into first formula: $P_0 = \dfrac{E[Div_1]}{1+r} + \dfrac{E[Div_2]}{(1+r)^2} + \dfrac{E[P_2]}{(1+r)^2}$

If prices are rational, then repeating for P_2, P_3, …, gives the dividend discount formula

Approach 2 – Dividends

Equity value

$$\text{PV of equity} = \frac{\text{Div}_1}{1+r} + \frac{\text{Div}_2}{(1+r)^2} + \ldots + \frac{\text{Div}_H}{(1+r)^H} + \frac{\text{Term. value}}{(1+r)^H}$$

Special cases

- **No growth**
  Mature firms, few new investment opportunities
  Ex. Kodak, AT&T

- **Sustainable growth**
  Firms with moderate growth that is expected to persist
  Ex. IBM, Procter and Gamble

Case 1: No growth

No net investment

- **Reinvestment covers depreciation**
- **Firm pays out all its earnings: $Div_t = EPS_t$**
- **Equity value, dividends, earnings aren't expected to grow**

$Div_0 = E[Div_t] = E[Div_2] = \dots$

$$\text{Price} = \frac{Div_0}{1+r} + \frac{Div_0}{(1+r)^2} + \frac{Div_0}{(1+r)^3} + \frac{Div_0}{(1+r)^4} \cdots$$

$$\boxed{\textbf{Price} = \frac{\mathbf{Div_0}}{\mathbf{r}} = \frac{\mathbf{EPS_0}}{\mathbf{r}}}$$

Example

It's 2001 and you're attempting to value AT&T's 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

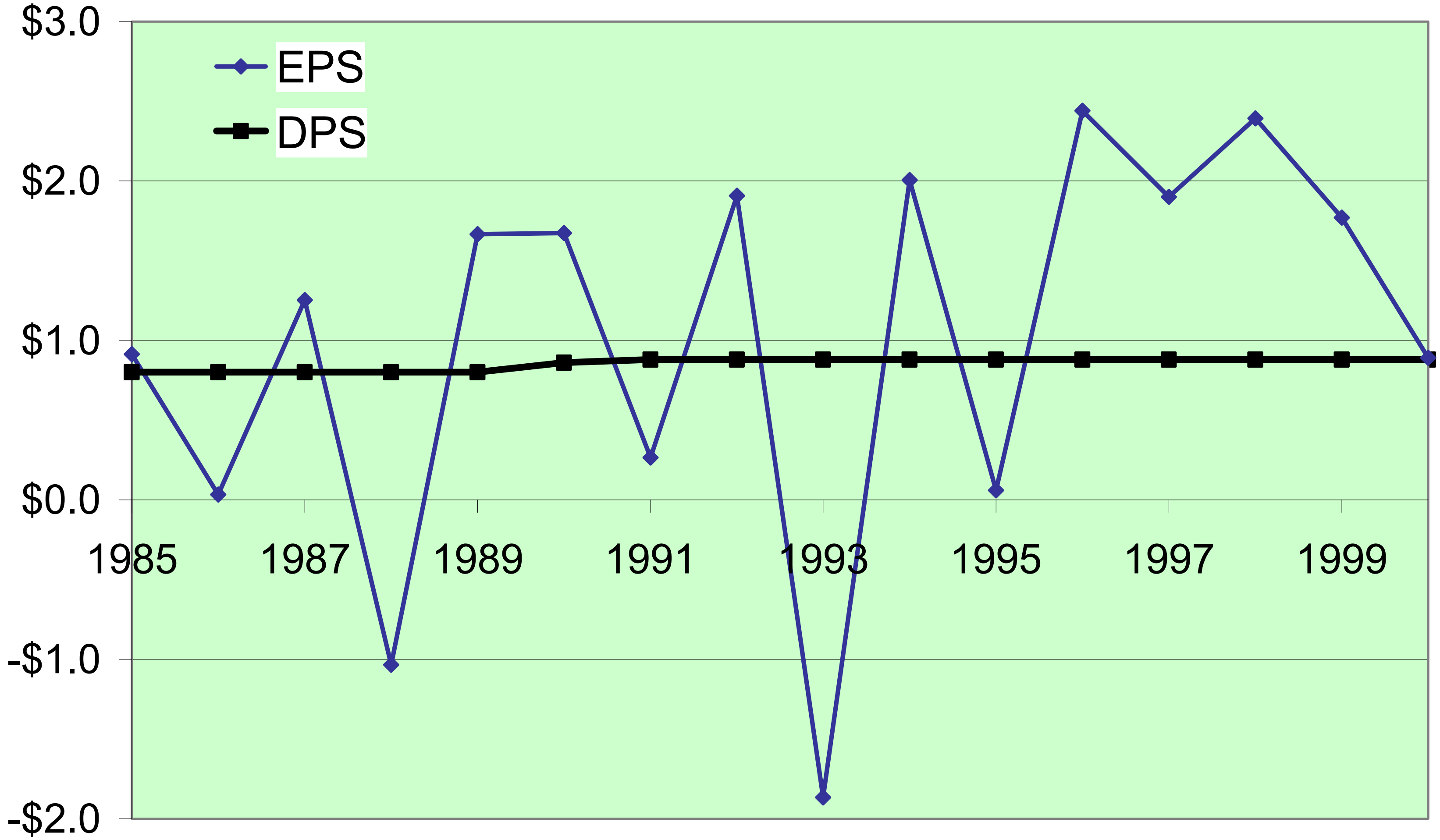
Year	1996	1997	1998	1999	2000
DPS	0.88	0.88	0.88	0.88	0.88

No growth formula:

If r = 7%: price = 0.88 / 0.07 = $12.57 (actual price = $17.25)

If r = 5%: price = 0.88 / 0.05 = $17.60

AT&T earnings and dividends



Case 2: Sustainable growth

Growth opportunities

- **Positive net investment** (reinvestment > depreciation)
- **Firm pays out only a portion of its earnings** ($Div_t < EPS_t$)
- **Equity, dividends, earnings are all expected to grow**

Exp[Div]: $Div_0 \times (1+g)$, $Div_0 \times (1+g)^2$, …

$$\text{Price} = \frac{Div_0(1+g)}{1+r} + \frac{Div_0(1+g)^2}{(1+r)^2} + \frac{Div_0(1+g)^3}{(1+r)^3} + \cdots$$

$$\textbf{Price} = \frac{\mathbf{Div_1}}{\mathbf{r-g}} = \frac{\mathbf{Div_0 \times (1+g)}}{\mathbf{r-g}}$$

Example

Firms in the S&P 500 are expected to pay, collectively, around $20 in dividends next year. Dividends have grown 5.57% annually since 1950. If the historical pattern continues, what is the value of index if the discount rate is 8%?

- **Constant growth**

$$\text{Value} = \frac{20.0}{(1.08)} + \frac{21.11}{(1.08)^2} + \frac{22.29}{(1.08)^3} + \ldots = \frac{20}{0.08 - 0.0557}$$

$$= 823.05$$

Current index level = 989.28

Forecasting growth

How quickly will the firm grow?

Payout ratio = DPS / EPS
Plowback ratio = 1 – payout ratio = retained earnings / EPS

If growth is financed internally:

$\Delta \text{Equity}_{t-1 \text{ to } t}$ = retained earnings = EPS × plowback ratio

$$\text{Growth rate} = \Delta \text{Equity}_{t-1 \text{ to } t} / \text{Equity}_{t-1}$$

$$= \frac{\text{EPS} \times \text{plowback}}{\text{Equity}}$$

$$= \text{ROE} \times \text{plowback}$$

Growth rate = g = ROE × plowback ratio

Forecasting growth

Observations

- Growth is faster if ROE is high
- Growth is faster if plowback is high
- Growth $\neq$ good investments
- If margins and payout are constant, equity, dividends, and earnings all grow at the same rate

$EPS_t = ROE \times equity_{t-1} \quad \Rightarrow \quad$ EPS growth = equity growth

$DPS_t = payout \times EPS_t \quad \Rightarrow \quad$ DPS growth = EPS growth

Example

Since 1950, firms in the S&P 500 have, on average, paid out 50.4% of their earnings as dividends. They have also been profitable, with an ROE of 11.7% annually. If these trends continue, how quickly will the firms grow? What will happen to growth if the payout ratio drops to 30% (including repurchases)?

Growth = plowback × ROE

If payout 50.4%

Growth = (1 – 0.504) × 11.7 = 5.8% (historical = 5.6%)

If payout 30%

Growth = (1 – 0.300) × 11.7 = 8.2% (if ROE doesn't change)

Example

By 2003, AT&T's situation had changed. Demand for long-distance and broadband is expanding. AT&T decides to reinvest half its earnings, equal to $1.50 / 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%

$g = 7.5\%$

Plowback ratio = 50%

$Div_{2002} = 0.75$

$EPS_{2002} = 1.50$

Example, cont.

Equity value

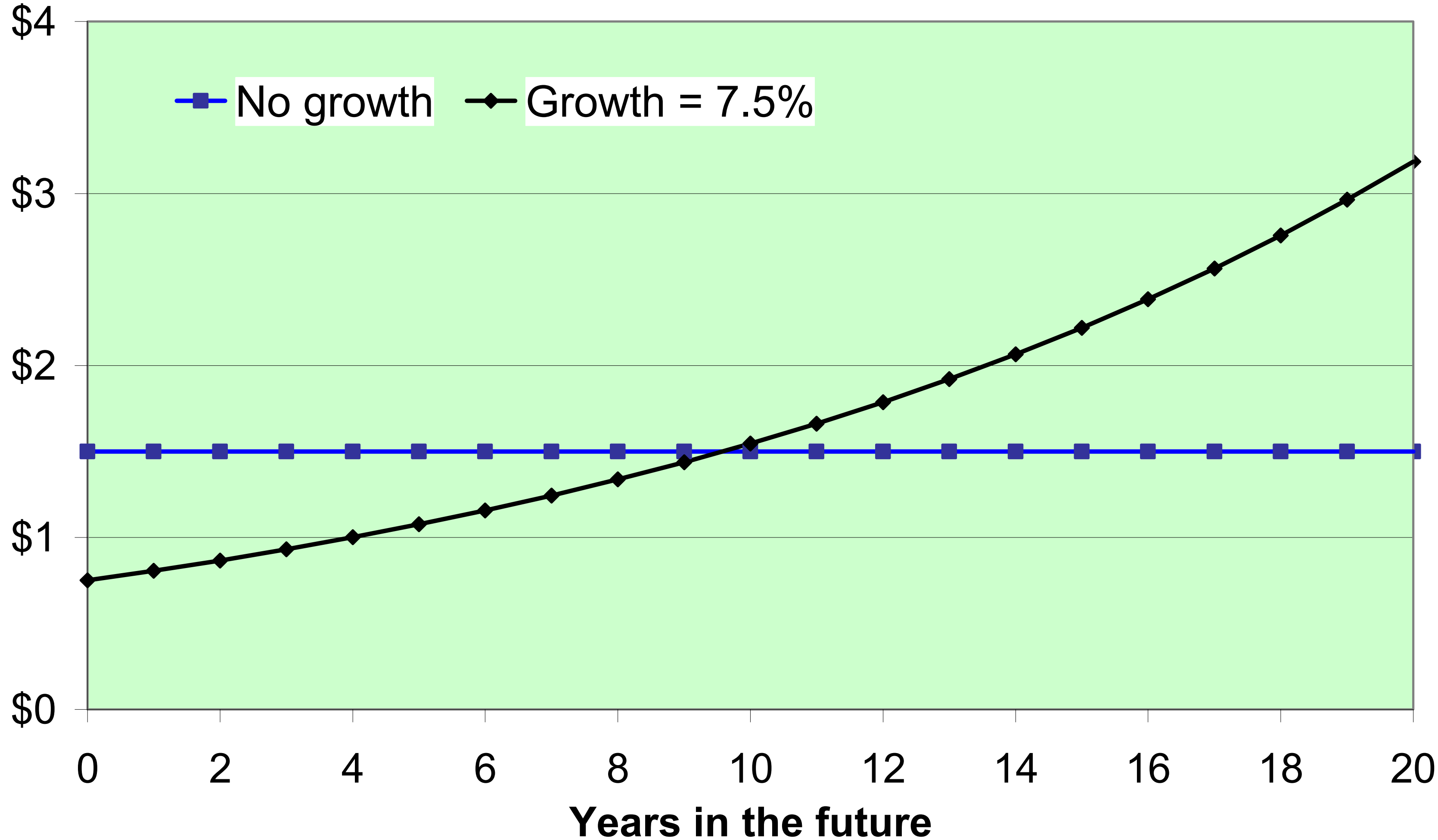
$\text{Div}_{2002} = 0.75 \quad \rightarrow \quad \text{Div}_{2003} = 0.75 \times 1.075 = 0.806$

Price = \$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



Example, cont.

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

ROE = 6%

$g = 3\%$

Plowback ratio = 50%

$\text{Div}_{2002} = 0.75$

$\text{EPS}_{2002} = 1.50$

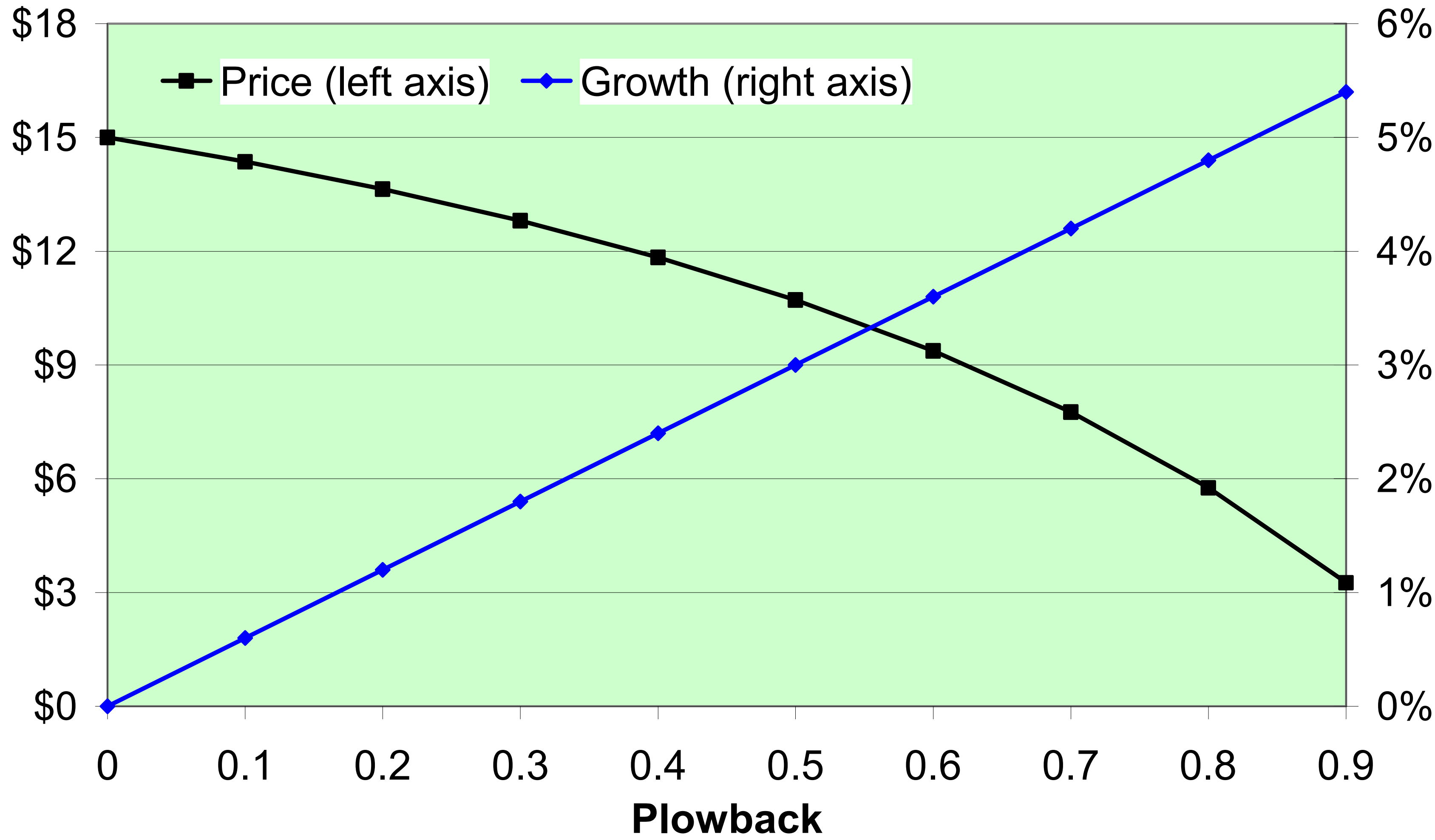
Stock price

$\text{Div}_{2002} = 0.75 \quad \rightarrow \quad \text{Div}_{2003} = 0.75 \times 1.03 = 0.773$

Price = \$0.773 / (0.10 – 0.03) = \$11.04

Growth drops the stock price from \$15 to 11.04. Growth $\neq$ growth opportunities!

Stock prices and plowback ratio



Growth

Approach 2

- **Begin with a mature, no growth firm**
  No reinvestment. Value derived from existing assets.

  $$\text{Price} = \frac{\text{Div}_0}{r} = \frac{\text{EPS}_0}{r}$$

- **Add in growth opportunities**

  $$\text{Price} = \frac{\text{EPS}_0}{r} + \text{NPVGO}$$

  NPVGO = ‘net present value of growth opportunities’.
  Price equals the value of existing assets plus the value of growth opportunities.

Example

IBM's stock price is \$97.14. Last year, IBM earned \$4.6 / share and paid dividends of \$0.55. What fraction of IBM's value comes from growth opportunities if r = 10%? How quickly must IBM grow to justify its price?

$$\text{Price} = \text{EPS} / r + \text{NPVGO}$$

$$= 4.6 / .10 + \text{NPVGO} \quad \rightarrow \quad \text{NPVGO} = 97.14 - 46 = \$51.14$$

$$\text{Fraction}_{\text{NPVGO}} = 51.14 / 97.14 = 53\%$$

Growth

$$\text{Price} = \text{Div} / (r - g) \quad \rightarrow \quad g = r - \text{Div} / \text{Price}$$

$$\text{Growth} = 0.10 - 0.55 / 97.14 = 9.4\%$$