15.401 Finance Theory I

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Lecture 4: Common Stocks

- Introduction to stock markets
- Discounted Cash Flow Model (DCF)
- Modeling cash flows
- EPS and ROE
- Growth opportunities and growth stocks
- P/E and PVGO

Readings:

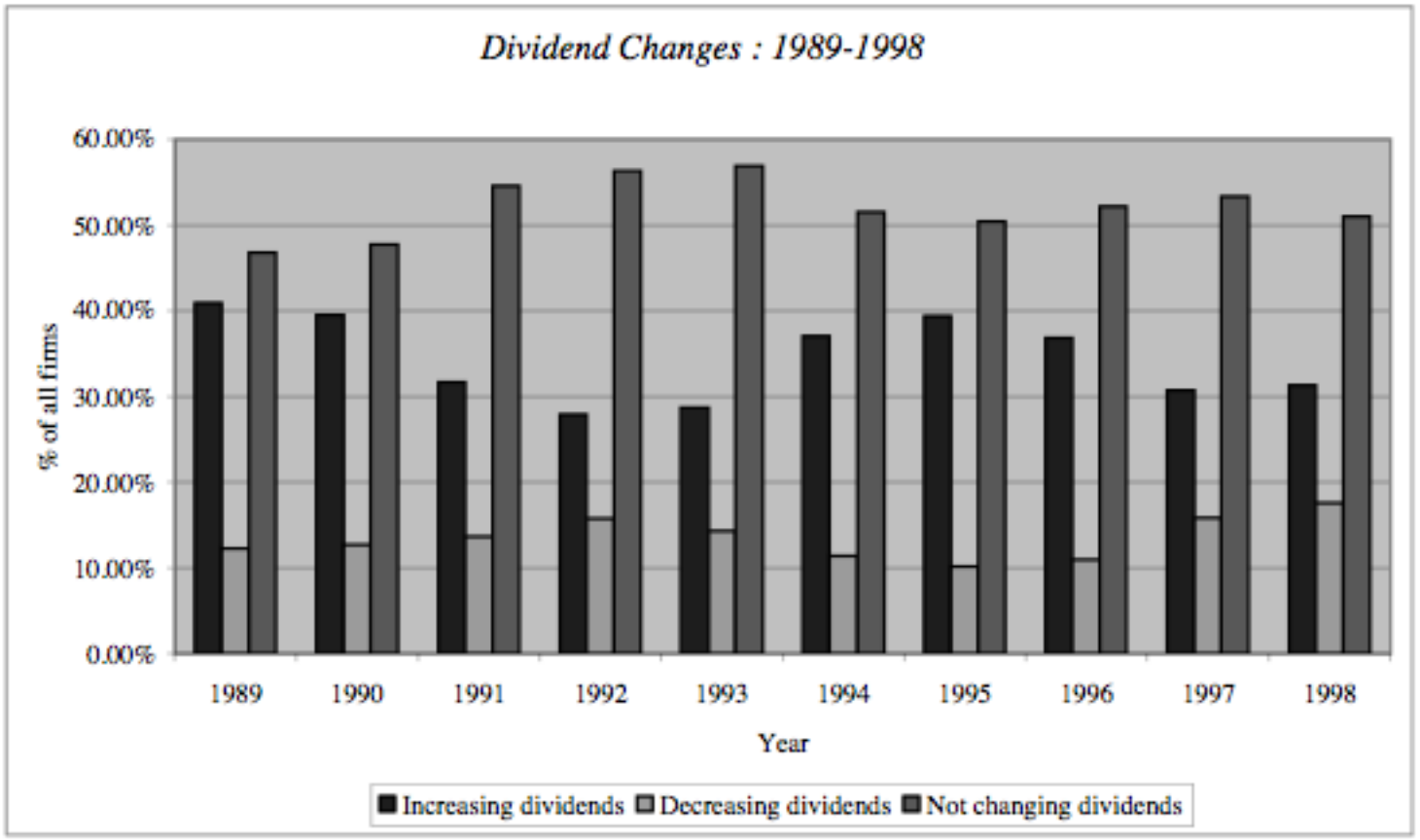
- Brealey, Myers and Allen, Chapter 5
- Bodie, Kane and Markus, Chapter 18

Common stock represents equity or an ownership position in a corporation.

- Payments to common stock are in the form of dividends:
  - cash dividend
  - stock dividend
  - share repurchase
- Contrary to payments to bondholders, payments to stockholders are uncertain in both magnitude and timing
- Traded in open markets (public vs. private)

Important characteristics of common stock:

- Residual claim - stockholders have claim to firm's cash flows/assets after all obligations to creditors are met
- Limited liability - stockholders may lose their investments, but no more
- Voting rights - stockholders are entitled to vote for the board of directors and on other major decisions


Dividend Changes : 1989-1998
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
% of all firms
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
Year
Increasing dividends
Decreasing dividends
Not changing dividends

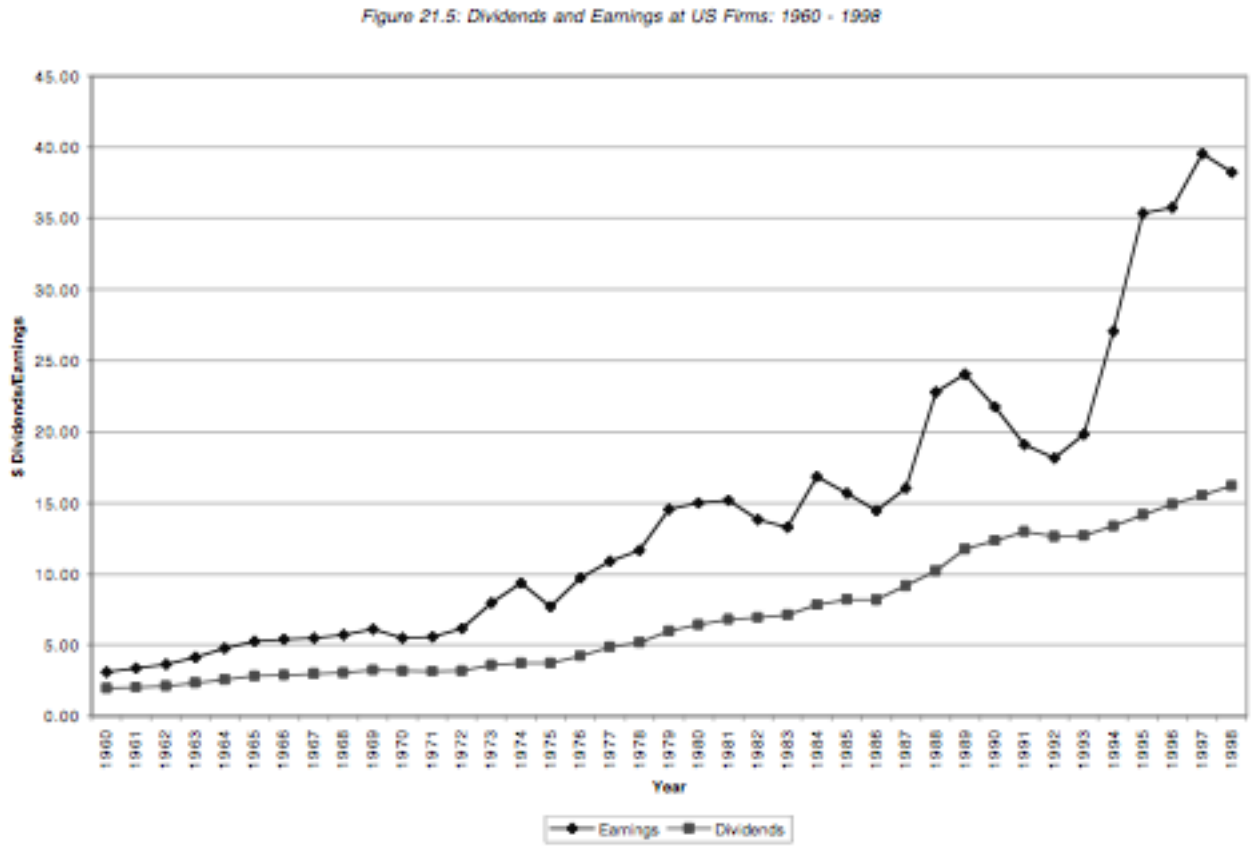
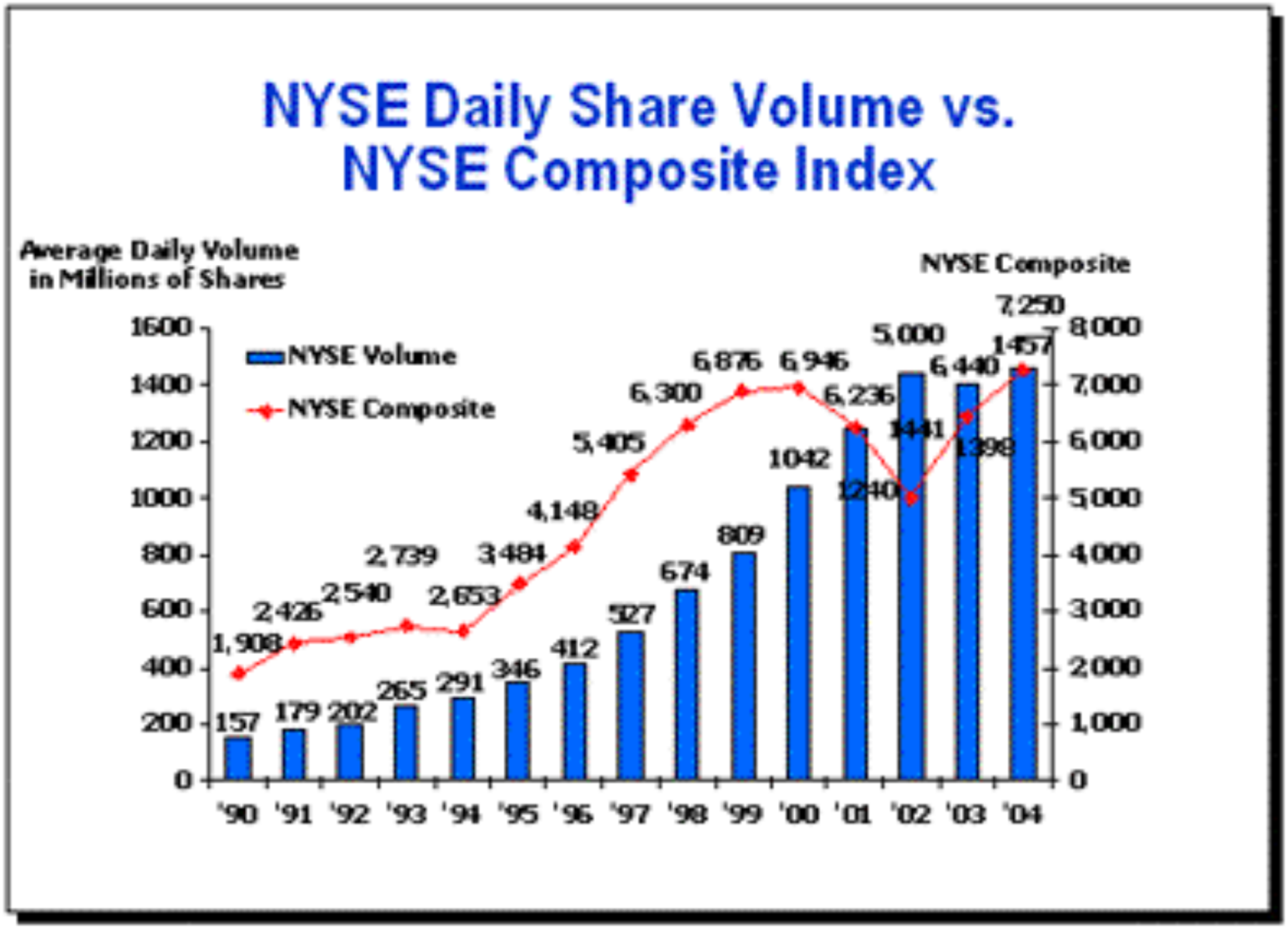
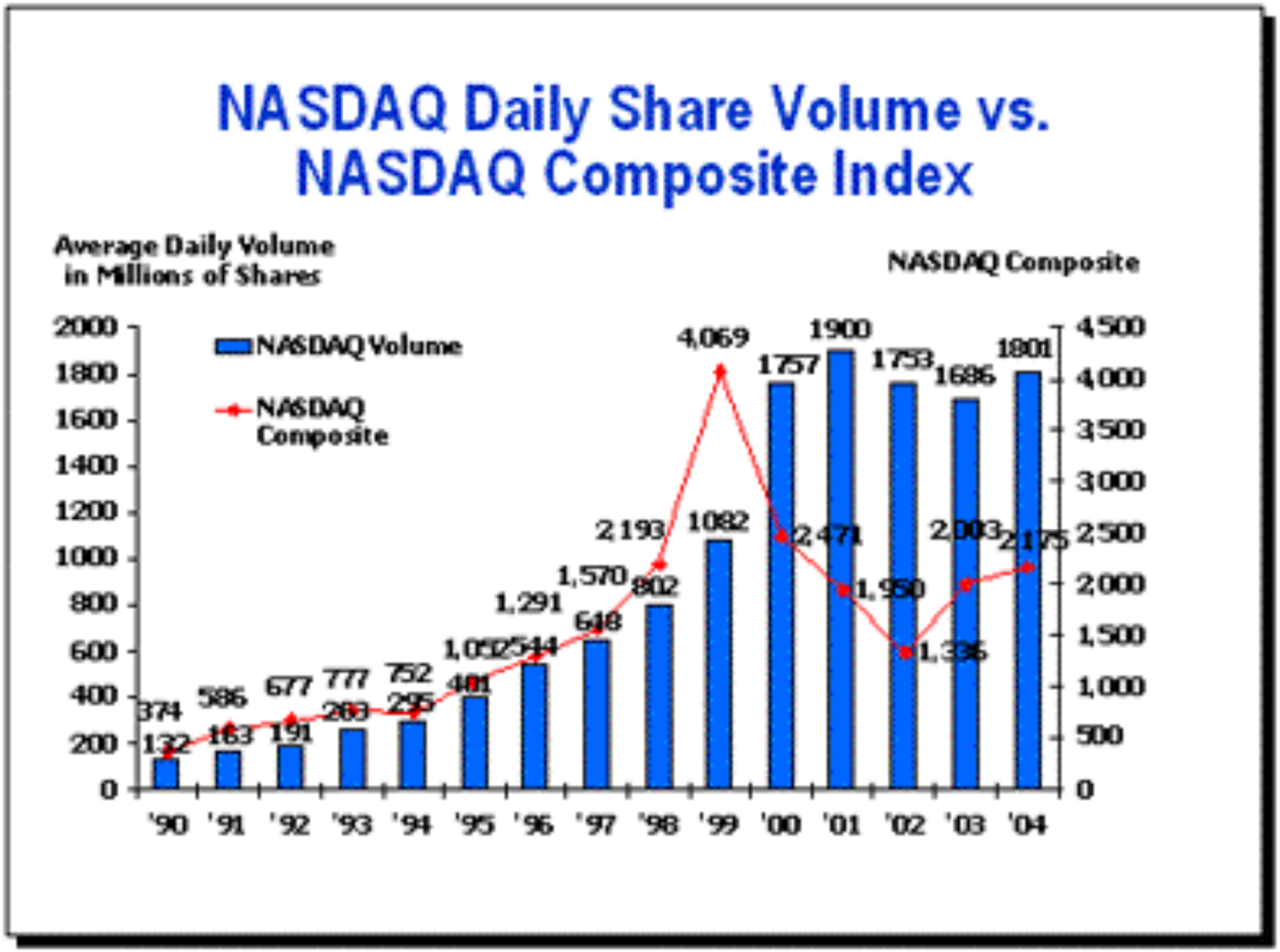


Figure 21.5: Dividends and Earnings at US Firms: 1960 - 1998
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
$ Dividends/Earnings
1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998
Year
Earnings
Dividends

1. Primary market - underwriting
   - Venture capital: A company issues shares to investment partnerships, investment institutions and wealthy individuals.
   - Initial public offering (IPO): A company issues shares to general public for the first time (i.e., going public).
   - Secondary (seasoned) offerings (SEO): A public company issues additional shares
   - Stock issuing to the public is usually organized by investment bank who act as underwriters.
2. Secondary market (resale market) - Exchanges and OTC
   - Exchanges: NYSE, AMEX, ECNs, …
   - OTC: NASDAQ
3. Trading in secondary market
   - Trading costs: commission, bid-ask spread, price impact
   - Buy on margin
   - Long and short


NYSE Daily Share Volume vs.
NYSE Composite Index
Average Daily Volume
in Millions of Shares
NYSE Composite
NYSE Volume
NYSE Composite
1600
1400
1200
1000
800
600
400
200
0
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
157
179
202
265
291
346
412
527
674
809
1042
1240
1441
1398
1457
1,908
2,426
2,540
2,739
2,653
3,484
4,148
5,405
6,300
6,876
6,946
6,236
5,000
6,440
7,250
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
'03
'04


NASDAQ Daily Share Volume vs.
NASDAQ Composite Index
Average Daily Volume
in Millions of Shares
NASDAQ Composite
NASDAQ Volume
NASDAQ
Composite
2000
1800
1600
1400
1200
1000
800
600
400
200
0
4500
4000
3500
3000
2500
2000
1500
1000
500
0
374
586
677
777
752
1,052
1,291
1,570
2,193
4,069
1,082
1,757
1,900
1,753
1,686
1,801
132
163
191
263
295
401
544
648
802
1,082
2,471
1,950
1,336
2,003
2,175
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
'03
'04

We will analyze the relation between the stock price and dividends.

There are three schools of thought on dividends:

- Dividends don't matter. Why? Because a company can always "undo" dividend payments by issuing stock. Or can it?
- Dividends are bad if they cause tax obligations. But how about stock repurchases?
- Dividend are (perceived as) good if they "signal" the future prospects of the firm.

In this lecture, we will take the investors' view: how to value a stock based on expectations about dividend payments.

Basic PV formula applies to the valuation of stocks. Need to know

- Expected future dividends
- Discount rates for dividends

Notation:

- P_t -- expected stock price at t (ex-dividend)
- D_t -- expected cash dividend at t
- r_t -- risk-adjusted discount rate for cash flow at t.

Dividend Discount Model (DCF)

Stock price is the present value of future dividends:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r_t)^t}$$

Constant Growth

Dividends are expected to grow at a constant rate g in perpetuity:

$$D_{t+1} = (1+g)D_t$$

Moreover: $r_t = r$. Then:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r_t)^t} = \frac{D_1}{r-g}$$

This is the Gordon Model:

$$P_0 == \frac{D_1}{r-g} = D_0 \frac{1+g}{r-g}$$

Example 1. Dividends are expected to grow at 6% per year and the current dividend is $1 per share. The expected rate of return is 20%.

$$P_0 == \frac{1.06}{0.2-0.06} = \$7.57$$

DCF with constant growth gives a relation between current stock price, current dividend, dividend growth rate and the expected return. Knowing three of the variables, we can determine the fourth.

Example. Determine cost of capital (the discount rate). Suppose the dividend yield for Duke Power is $D_0/P_0 = 0.052$. Estimates of long-run growth:

Info Source	Value Line (VL)	I/B/E/S
Growth g	0.049	0.041

The cost of capital is given by $r = \frac{D_1}{P_0} + g = \frac{(1+g)D_0}{P_0} + g$

Thus,

	Cost of Capital
VL	$r = (0.052)(1.049) + 0.049 = 10.35\%$
IBES	$r = (0.052)(1.041) + 0.041 = 9.51\%$

Cost of capital = Dividend yield + dividend growth.

Example. Estimate dividend growth rate. WSJ reported the following data on AT&T stock:

AT&T	DIV	YLD	P/E	High	Low	Last	Chg
	1.32	3.4	60	38.5	38.125	38.5	+.25

What is market's estimate of AT&T's dividend growth rate, if r = 12%?

Solving the valuation formula for g gives

$$g = \frac{r - D_0 / P_0}{1 + D_0 / P_0}$$

Since

$$P_0 = (38.5 + 38.125)/2 = 38.3125$$

$$D_0 / P_0 = 1.32 / 38.3125 = 0.03445$$

We have

$$g = \frac{0.12 - 0.03445}{1.03445} = 8.27\%$$

Multi-stage growth

Firms evolve through different stages in their lifecycles. For example,

1. Growth stage - rapidly expanding sales, high profit margins, and abnormally high growth in earnings per share, many new investment opportunities, low dividend payout ratio.
2. Transition stage - growth rate and profit margin reduced by competition, fewer new investment opportunities, high payout ratio.
3. Maturity stage - earnings growth, payout ratio and average return on equity stabilizes for the remaining life of the firm.

Multi-stage growth

1. In most applications, the dividends are modeled explicitly until the firm settles into steady-state growth.
2. The firm value is computed as follows:

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \ldots + \frac{D_t}{(1+r)^t} + \frac{1}{(1+r)^t}\frac{D_{t+1}}{r - g_{steady}}$$

Example. In Example 1 (D_0 = \$1 and r = 20%), suppose that the growth rate is 6% for the first 4 years and then drops to 2% steady state growth.

$$P_0 = \frac{\$1.06}{1.2} + \frac{\$1.06^2}{(1.2)^2} + \frac{\$1.06^3}{(1.2)^3} + \frac{1}{(1.2)^3}\frac{\$1.06^4}{0.2-0.02} = \$6.41$$

Notice: more than 60% of the firm value is due to the steady state growth.

Actual forecast of dividends involves many practical factors.

We need to understand the earnings process.

Terminology:

- Earnings (E or EPS): total profit net of depreciation and taxes
- Payout ratio: dividend/earnings = DPS/EPS = p
- Retained earnings: (earnings - dividends)
- Plowback ratio: retained earnings/total earnings = b
- Book value (BV): cumulative retained earnings
- Return on book equity (ROE): earnings/BV

Example. Texas Western (TW).

- Expected earnings $1.00 per share next year.
- Book value is $10.00 now.
- Plans an expansion to increase net book assets by 8% per year.
- Return on new investment is 10%.
- New investment is financed by retained earnings.
- Cost of capital is 10%, same as rate of return on new investments.

Price TW's shares if

- TW expands at 8% forever
- TW's expansion slows down to 4% after year 5

Here,

- Plowback ratio b = (10)(0.08)/(1) = 0.8
- Payout ratio p = (1-0.8)/(1) = 0.2
- ROE = 10% = r (cost of capital)

- Plowback ratio b = 0.8
- Payout ratio p = 0.2
- ROE = 10% = r

1. No expansion. D=E=$1.0 and

$$P_0 = \frac{E}{r} = \frac{\$1}{0.1} = \$10$$

2. Continuing expansion.

$$g = ROE\ b = 0.10\ 0.8 = 0.08$$

$$D_1 = EPS_1 p = 0.2$$

$$P_0 = \frac{D_1}{r - g} = \frac{0.2}{0.1 - 0.08} = \$10$$

Why are the values the same under these scenarios?

3. 2-stage expansion. Forecast EPS, D, BVPS by year:

		b=80%					b=40%
Year	0	1	2	3	4	5	6
EPS		1.00	1.08	1.17	1.26	1.36	1.47
Investment	10%	0.80	0.86	0.94	1.00	1.08	0.59
Dividend		0.20	0.22	0.23	0.26	0.28	0.88
BVPS	10.00	10.80	11.66	12.60	13.60	14.69	15.28

$$P_0 = \sum_{t=1}^{5} \frac{D_t}{1.1^5} + \frac{1}{1.1^5}\frac{0.88}{0.1-0.04} = \$10$$

Growth opportunities are investment opportunities that earn expected returns higher than cost of capital.

Stocks of companies that have access to significant growth opportunities are considered growth stocks.

- The following may not be growth stocks
  - A stock with growing EPS
  - A stock with growing dividends
  - A stock with growing assets
- The following may be growth stocks
  - A stock with EPS growing slower than cost of capital
  - A stock with DPS growing slower than cost of capital

Example. ABC Software has the following data: Expected EPS next year is \$8.33; Payout ratio is 0.6; ROE is 25%; and, cost of capital r = 15%.

Thus,

$$D_1 = p\ EPS = 0.6\ 8.33 = \$5$$

$$g = b\ ROE = 0.4\ 0.25 = 0.1$$

- Following a no-growth policy (g=0, p=1), its value is

$$P_0 = \frac{D_1}{r-g} = \frac{EPS_1}{r} = \frac{8.33}{0.15} = \$55.56$$

- Following the growth policy, its price is

$$P_0 = \frac{D_1}{r-g} = \frac{5}{0.15-0.1} = \$100$$

- The difference of 100-55.56 = \$44.44 comes from the growth opportunities, which offers a return of 25% > cost of capital 15%.

Stock price has two components:

1. Present value of earnings under a no-growth policy
2. Present value of growth opportunities

$$P_0 = \frac{EPS_1}{r} + PVGO$$

Terminology:

- Earnings yield: E/P = EPS_1/P_0
- P/E ratio: P/E = P_0/EPS_1

(Note: In business media, E/P is often quoting EPS_0/P_0 rather than EPS_1/P_0. But finance is forward looking.)

Thus,

- If PVGO = 0, P/E ratio equals inverse of cost of capital

$$P / E = \frac{1}{r}$$

- If PVGO> 0, P/E ratio becomes higher:

$$P / E = \frac{1}{r} + \frac{PVGO}{EPS_1} > \frac{1}{r}$$

- PVGO is positive only if firm earns more than the cost of capital

Consider the simple case in which the plowback ratio b, ROE, and r are constant forever.

$$PVGO = \frac{1}{1+r}\underbrace{EPS_1 b\left(-1+\frac{ROE}{r}\right)}_{NPV_1} + \frac{1}{(1+r)^2}\underbrace{EPS_2 b\left(-1+\frac{ROE}{r}\right)}_{NPV_2} + \ldots$$

Since $EPS_2 = (1+g)\,EPS_1$, we obtain:

$$PVGO = NPV_1\frac{1}{1+r} + NPV_1\frac{1+g}{(1+r)^2} + \ldots$$

Looks like a growing annuity…

$$PVGO = NPV_1 \frac{1}{1+r} + NPV_1 \frac{1+g}{(1+r)^2} + \ldots = \frac{NPV_1}{r-g}$$

Let's go back to the previous example:

ROE=25%, r=15%, g=10%, b=40%

EPS_1=\$8.33

$$NPV_1 = EPS_1 b\left(-1+\frac{ROE}{r}\right) = \$8.33\ 0.4\left(-1+\frac{0.25}{0.15}\right) = \$2.22$$

$$PVGO = \frac{NPV_1}{r-g} = \frac{\$2.22}{0.25-0.15} = \$44.44$$

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