Equity Analysis and Valuation

V. Dividend Discount Models

Text: Damodaran, A., 2012, Investment Valuation: Tools and Techniques for Determining the Value of any Asset, 3rd Edition, John Wiley & Sons.

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Key Learning Outcome:

I. The General Model of Dividend Discount Model (DDM)
II. The Gordon Growth Model (GGM)
III. Two-Stage Dividend Discount Model
IV. The Value of Growth: The H Model
V. Issues in Using the Dividend Discount Model

The General Model of Dividend Discount Model (DDM)

- The underlying concepts for the Dividend Discount Model (DDM) are that:

  1) An intrinsic value of an asset is the present value of its (expected) future cash flows discounting at a risk-adjusted discount rate.

  2) When an investor buys stock, he or she will get two types of cash flows—**dividends during the period the stock is held** and an **expected price at the end of the holding period**.

  3) Since this expected price at the end of the holding period itself is determined by future dividends, the value of a stock (**intrinsic value, fair value**) is the present value of dividends through infinity.

$$\text{Value per share of stock} = \sum_{t=1}^{t=\infty} \frac{E(DPS_t)}{(1+k_e)^t}$$

where DPS_t = Expected dividends per share

k_e = Cost of equity

The Gordon Growth (GGM)

- **The Gordon growth model (GGM)** can be used to value a firm that is in "**steady state**" with dividends growing at a rate that can be sustained forever (**stable growth rate**).

$$\text{Value of stock} = \frac{\text{Expected dividends next period}}{(\text{Cost of equity} - \text{Expected growth rate in perpetuity})}$$

$$\text{Value of stock} = \frac{D_0(1+g)}{(k-g)}$$

* Value of stock = present value of growing perpetuity

D_0 = Current year dividends per share
g = Sustainable growth rate
k = Cost of equity

- The sustainable growth rate (g) cannot exceed the cost of equity (k). If g exceeds k, the value per share becomes negative.
- The sustainable growth rate (g) can be estimated base on the sustainable growth rate (SGR) formula:

g = Retention ratio x ROE

II The Stable Growth Rate

There are two insights worth keeping in mind when estimating a stable growth rate:

- Since the growth rate in the firm's dividends is expected to last forever, the firm's **other measures of performance can also be expected to grow at the same rate.** Thus, you should be able to substitute in the **expected growth rate in earnings** and get precisely the same result, if the firm is truly in steady state.
- **The stable growth rate (g) should be less than or equal to the growth rate of the economy.** No firm can be assumed to grow forever at a rate that exceeds the **growth rate of the economy (**or as a proxy, **the risk-free rate)**. At the same time, the cost of equity has to be consistent with the firm being mature (**beta should be close to 1** —the rule of thumb that the beta should be between 0.8 and 1.2).

II GGM Works Best For

The Gordon growth model is best suited for:

- Firms growing at a rate **equal to or lower than the nominal growth in the economy** with well-established **dividend payout policies** that they intend to continue into the future.
- The **dividend payout and cost of equity** of the firm have to be consistent with the assumption of stability, since **stable firms generally pay substantial dividends and have betas close to 1**.

*** This model will **underestimate the value** of the stock in firms that consistently **pay out less than they can afford to and accumulate cash in the process**.

Which industries that you think GGM is suitable for?

Example: Gordon Growth Model (GGM)- Con Ed

- Consolidated Edison (Con Ed) is the electric utility that supplies power to residences and businesses in New York City. It is a quasi-monopoly whose prices and profits are regulated by the state of New York.
  - The firm operates in a region where the population and power usage have leveled off over the past few decades.
  - The regulatory authorities will restrict price increases to be about the inflation rate.
  - The firm has had a stable mix of debt and equity funding its operations for decades.
  - Con Ed has a clientele of dividend-loving investors, and attempts to pay out as much as it can in dividends. During the period 2006–2010, the firm returned about 95% of its free cash flows to equity (FCFE) as dividends.

Example: Gordon Growth Model (GGM)- Con Ed (cont.)

- To value the company using the stable growth dividend discount model, we start with the **earnings per share of $3.47** that the firm reported for 2010 and the **dividends per share of $2.22** it paid out for the year. Using the **average beta of 0.80** for power utilities and an **equity risk premium of 5%** for mature markets allows us to estimate a cost of equity of 7.5% (the risk-free rate was 3.5%)

  Cost of equity = 3.5% + 0.8(5%) = 7.5%

  Capping the growth rate at the risk-free rate of 3.5%, we generated a value per share of **$57.46 [=(2.22*(1.035)/(7.5%-3.5%)]**.
- We check to see whether the expected growth rate was consistent with fundamentals for Con Ed.

  Retention ratio = 1 − ($2.22/$3.47) = 36% Return on equity = 9.79% Expected growth rate = .36 × .0979 = .0352 = 3.52%
- The fundamental growth rate is very close to our estimate of growth of 3.5%.
- The stock was trading at $53.47 a share in May 2011, making it slightly under valued.

III Two-Stage Dividend Discount Model

- The two-stage growth model allows for two stages of growth—**an initial phase** where the growth rate is **not a stable growth rate** and a **subsequent steady state** where the growth rate is stable and is expected to remain so for the long term.
  - In most cases, the growth rate during the initial phase is higher than the stable growth rate. However, the model can be adapted to value companies that are expected to post low or even negative growth rates for a few years and then revert back to stable growth.

Two-Stage DDM: $Value_0 = Initial\ phase\ value_0 + Terminal\ Value_0$

Not stable growth rate each year for n years — Stable growth: g_n forever.

0 — Initial phase — n — Steady phase

$Value_0 =$

Initial phase $value_0 = \sum_{t=1}^{t=n} \frac{E(DPS_t)}{(1+k_e)^t}$

$Terminal\ Value_n = D_1 / (k-g)$

$g = Retention\ ratio \times ROE$

$Terminal\ Value_0 = Terminal\ value_n / (1+k)^{\wedge n}$

Example: Two-stage DDM (OISHI)

In the excel file

(Assignment: OISHI)

III Two-Stage Dividend Discount Model: Two-stage of Different Constant Growth

- In the case where the extraordinary **growth rate (g) and payout ratio are unchanged for the first n years**, the formula for two-stage DDM is as follows:

$$P_0 = \frac{D_0(1+g_S)}{r-g_S}\left(1-\frac{(1+g_S)^n}{(1+r)^n}\right)+\frac{D_0(1+g_S)^n(1+g_L)}{(1+r)^n(r-g_L)}$$

g_S = high growth during the first stage,
g_L = low growth during the second stage
n = strong growth period

Example: Two-stage DDM (Two-stage of Different Constant Growth)

- A company pays $1.00 dividend per share for the current year. The company currently enjoy a high dividend growth rate of 30%. If we assume that the high dividend growth will continue for 6 years before it will decline to a stable growth rate of 6%, what is the company's stock value at the required rate of return of 12%?
  - D_0=1.00, g_S=30%, g_L=6%, n = 6, and r=12%

$$V_0 = \frac{1.00(1.30)}{0.12-0.30}\left(1-\frac{(1.30)^6}{(1.12)^6}\right)+\frac{1.00(1.30)^6(1.06)}{(1.12)^6(0.12-0.06)}$$

$$V_0 = -7.222(-1.4454)+\frac{85.274}{(1.12)^6} = 10.439+42.202 = 53.64$$

Source: Equity Asset Valuation by Stowe, J., T. Robinson, J. Pinto, and D. McLeavey, 2010, 2nd edition, John Wiley & Sons.

Example: Two-stage DDM (cont.)

Time	Value	Calculation
1	D_1	$1.00(1.30)$
2	D_2	$1.00(1.30)^2$
3	D_3	$1.00(1.30)^3$
4	D_4	$1.00(1.30)^4$
5	D_5	$1.00(1.30)^5$
6	D_6	$1.00(1.30)^6$
6	V_6	$1.00(1.30)^6(1.06) / (0.12 - 0.06)$
Total		

Source: Equity Asset Valuation by Stowe, J., T. Robinson, J. Pinto, and D. McLeavey, 2010, 2nd edition, John Wiley & Sons.

III Limitations of the Two-stage DDM

There are three limitations of the two-stage DDM; the first two would apply to any two-stage model, and **the third is specific to the dividend discount model.**

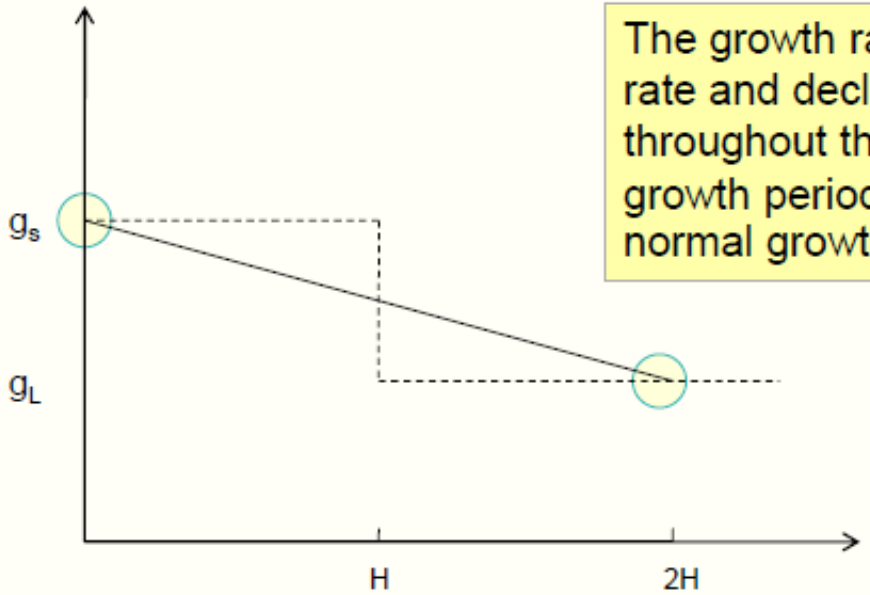
- The first practical problem is in **defining the length of the extraordinary growth period.**
- The second problem arises from the two-stage DDM formula (two-stages with different constant growth) is that this model lies in the **assumption that the growth rate is high during the initial period and is transformed overnight to a lower stable rate** at the end of the period. While these sudden transformations in growth can happen, **it is much more realistic to assume that the shift from high growth to stable growth happens gradually over time.**
- The focus on dividends in all DDM models can lead **underestimate** the value of firms that **are not paying out what they can afford to in dividends,** in particularly, firms that **accumulate cash and pay out too little in dividends.**

III Two-stage DDM Works Best For

- The two-stage DDM is best suited for **firms that are expect to maintain a high growth rate for a specific time period, after which the sources of the high growth are expected to disappear.**
  - One scenario, for instance, where this may apply is when a company has **patent rights to a very profitable product for the next few years**, and is expected to enjoy supernormal growth during this period. Once the patent expires, it is expected to settle back into stable growth.
  - Another scenario where it may be reasonable to make this assumption about growth is when a firm is in an industry that is enjoying supernormal growth because there are significant barriers to entry (either legal or as a consequence of infrastructure requirements), which can be expected to keep new entrants out for several years.
- The model works best for firms that maintain a policy of **paying out residual cash flows (**i.e., cash flows left over after debt payments and reinvestment needs have been met) **as dividends**.

IV The Value of Growth: The H Model

- Fuller and Hsia (1984) developed a variant of the two-stage model.
- The H Model is based on the assumption that the earnings growth rate starts at a high initial rate (g_a) and **declines linearly** over the extraordinary growth period (which is assumed to last 2H periods) to a stable growth rate (g_n).
- The H Model assumes that **the dividend payout and cost of equity are constant over time**, and are not affected by the shiftin[illegible]



The growth rate begins at a high rate and declines linearly throughout the super-normal growth period until it reaches the normal growth rate at the end.

IV

The Value of Growth: The H Model (cont.)

- The value of expected dividends in the H model can be written as follows:

$$P_0 = \frac{D_0(1+g_L)}{r-g_L} + \frac{D_0 H(g_S - g_L)}{r-g_L}$$

P_0 = value per share at time zero D_0 = current dividend
r = required rate of return on equity g_S = initial short-term dividend high growth rate during 2H years
g_L = normal long-term dividend growth rate after year 2H
H = half-life of the high growth period (i.e., high growth period = 2H years)

IV

Example: The H Model (Vodafone)

- Vodafone, a UK-based telecommunications firm, paid dividends per share of 9.8 pence on earnings per share of 16.1 pence in 2010.
- The firm's earnings per share had grown at 6% over the prior five years (2011-2015) but the growth rate is expected to decline linearly over the next five years to 3%, while the pay- out ratio remains unchanged. The beta for the stock is 1, the risk-free rate in British pounds is 4% and the market risk premium is 5%.

$$P_0 = \frac{D_0(1+g_L)}{r-g_L} + \frac{D_0 H(g_S - g_L)}{r-g_L}$$

- Cost of equity = 4.00% + 1.0(5.00%) = 9.00%
- **Value of stable growth** = $\frac{(9.8)(1.03)}{(0.09 - 0.03)}$ = 168 pence
- **Value of extraordinary growth** = $\frac{(9.8)(5/2)(0.06 - 0.03)}{(0.09 - 0.03)}$ = 12 pence
- **Value of stock at end-2010** = 168 pence + 12 pence = 180 pence
- The stock was trading at 173.3 pence in May 2011, making it slightly under-valued.

IV Limitations of the H Model

There are two limitations of the H Model.

- First, the decline in the growth rate is expected to follow the strict structure laid out in the model—it drops in **linear increments** each year based on the initial growth rate, the stable growth rate, and the length of the extraordinary growth period. **Large deviations can cause problems.**
- Second, the assumption that the **payout ratio and cost of equity are constant** through both phases of growth exposes the model to an inconsistency—as growth rates decline, the payout ratio usually increases.

IV The H Model Works Best For

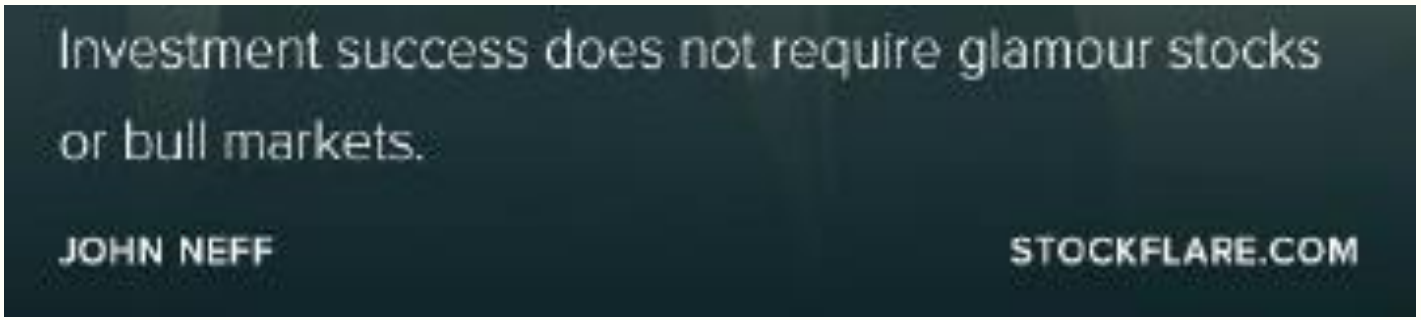
- The allowance for a gradual decrease in growth rates over time may make this a useful model for firms that are growing rapidly right now, but where the **growth is expected to decline gradually** over time as the firms **get larger** and the **differential advantage they have over their competitors declines**.
- The assumption that the **payout ratio is constant**, however, makes this an **inappropriate** model to use for any firm that has **low or no dividends currently**.

Issues in Using the DDM: Sensitivity to the Growth Rate

- Dividend discount model (DDM) is extremely sensitive to assumptions about the **growth rate**, as long as other inputs to the model (payout ratio, cost of equity) are kept constant.
- Actually, growth is not free; **when the growth rate is increased, the payout ratio should be decreased (and vice versa)**.
- When a firm enters into a steady growth stage, where its growth becomes close to the growth rate of the economy (or as a proxy, the risk-free rate), its the cost of equity has to be consistent with the firm being mature (beta should be close to 1). As a result, **higher stable growth rate assumption should lead to higher cost of equity**.
- These creates a **trade-off on growth**, with the net effect of increasing growth being positive, neutral, or even negative.

V Investors Tends to Overpay for Growth

- **Investors pay a premium when they acquire companies with high growth potential.** This premium takes the form of higher price-earnings. While no one will contest the proposition that growth is valuable, it is possible to pay too much for growth.
- In fact, empirical studies that show low **price-earnings ratio stocks earning return premiums over high price-earnings ratio stocks** in the long term support the notion that investors overpay for growth.



Assignments:

Damodaran, A., 2012, Investment Valuation: Tools and Techniques for Determining the Value of any Asset, 3rd Edition

- Read chapter 13 – Dividend Discount Models (pages 323 – 332, 335 – 336, 338 – 340, 348)

- **OISHI case: Two-stage DDM**
- End of chapter 13 exercises (questions 2,3,6)*