

Dividend Discount Model

Equity Analysis FN 451: Part II Fundamental Analysis

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Topics to be Discussed:

- I. The Gordon Growth Model (GGM)
- II. Valuing the entire Market Using the GGM
- III. The General Version of DDM
- IV. Two-Stage DDM
- V. The H Model
- VI. Limitations and Issues in Using the DDM



The General Model of Dividend Discount Model (DDM)

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

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

where DPS_t = Expected dividends per share
 k_e = Cost of equity



The Gordon Growth Model

- The **Gordon growth model (GGM)** or the **constant growth DDM** 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**).

$$V_0 = \frac{D_0(1+g)}{r-g} = \frac{D_1}{r-g}$$

Total Stock Return = dividend Yield + Capital Gain Yield

* *Capital gain yield for a stable firm is “g”.*

- 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:

$$g = \text{Retention ratio}_0 \times \text{ROE}_1$$

The Gordon growth model (GGM) was named in the 1960s after Myron J. Gordon, was professor of finance at the Rotman School of Management, University of Toronto.



Example: Valuing Common Stock Using the Gordon Growth Model

Risk-free rate	3.0%
Equity risk premium	6.0%
Beta	1.20
Current dividend	\$2.00
Dividend growth rate	5.0%
Current stock price	\$24.00

$$\text{CAPM: } r = 3\% + 1.2(6\%) = 10.2\%$$

$$V_0 = \frac{\$2.00(1 + 0.05)}{0.102 - 0.05} = \frac{\$2.10}{0.102 - 0.05} = \$40.38$$

Source: Equity Asset Valuation, 3rd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons



Example: Calculating the Implied Growth Rate Using the Gordon Growth model

Using the previous common stock example and the current stock price of \$24, what is the **implied growth rate**?

$$\$24 = \frac{\$2.00(1 + g)}{0.102 - g}$$

$$2.448 - 24g = 2.00(1 + g)$$

$$-26g = -0.448$$

$$g = 1.72\%$$

Source: Equity Asset Valuation, 3rd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons



Example: Calculating the Implied Required Return Using the Gordon Growth Model

Using the previous common stock example and the current stock price of \$24, what is the **implied required return**?

$$r = \frac{D_1}{P_0} + g$$

$$r = \frac{2.10}{24} + 0.05$$

$$r = 8.75\% + 5\% = 13.75\%$$

Source: Equity Asset Valuation, 3rd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons



Valuing an Entire Market Using the Constant Growth DDM

Constant growth DDM can be applied to value **a sector** or **the entire market**.

- The **market price** of the stock would be replaced by the cumulative market value of all of the stocks in the sector or market (i.e. the **market index**).
- The **expected dividends** would be the cumulated dividends of all these stocks (i.e. the **market dividend yield**).
- The **expected growth rate** would be the growth rate in cumulated earnings of the index.
- There would be no need for a beta, since you are looking at the entire market (a beta of 1). You could just add the risk premium to the risk-free rate to estimate a cost of equity.



Case Study: Valuing an Entire Market Using the GGM – SET

- The current level of the SET index is 1590.8 (27 Jan, 2017). The **expected dividend yield** on the index is **3.50%**, and the **expected growth rate** in earnings and dividends in the long term is **6.50%**. 10-years zero-coupon Thailand government bond yield is 2.79%. Historical market risk premium for the SET is 7.96%. Find the value of the SET index.
 - Market required rate of return = Riskless rate + Market Risk premium
 $= 2.79\% + 7.96\% = 10.75\%$
 - Expected dividends next year = (Dividend yield \times Value of the index)
 $= (3.50\% \times (1590.8 \times (1.065))) = 59.297$
 - Value of the index = Expected dividends next year / (Cost of equity – Expected growth rate)
 $= 59.297 / (10.75\% - 6.50\%) = \mathbf{1,395.2}$
 - At its existing level of **1590.8**, the market is 14% overpriced.

Do you think that the SET is really overpriced? Why?



The general version of DDM

- The general version of DDM allows for two phases 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.

Multiperiod DDM: $\text{Value}_0 = \text{Initial phase value}_0 + \text{Terminal Value}_0$

Not stable growth rate each year for n years

Stable growth: g_n forever.

0 Initial phase: Growth, Transition

n Maturity phase

Value₀ =

$$\text{Initial phase} = \text{value}_0 = \sum_{t=1}^{t=n} \frac{E(\text{DPS}_t)}{(1+k_c)^t}$$

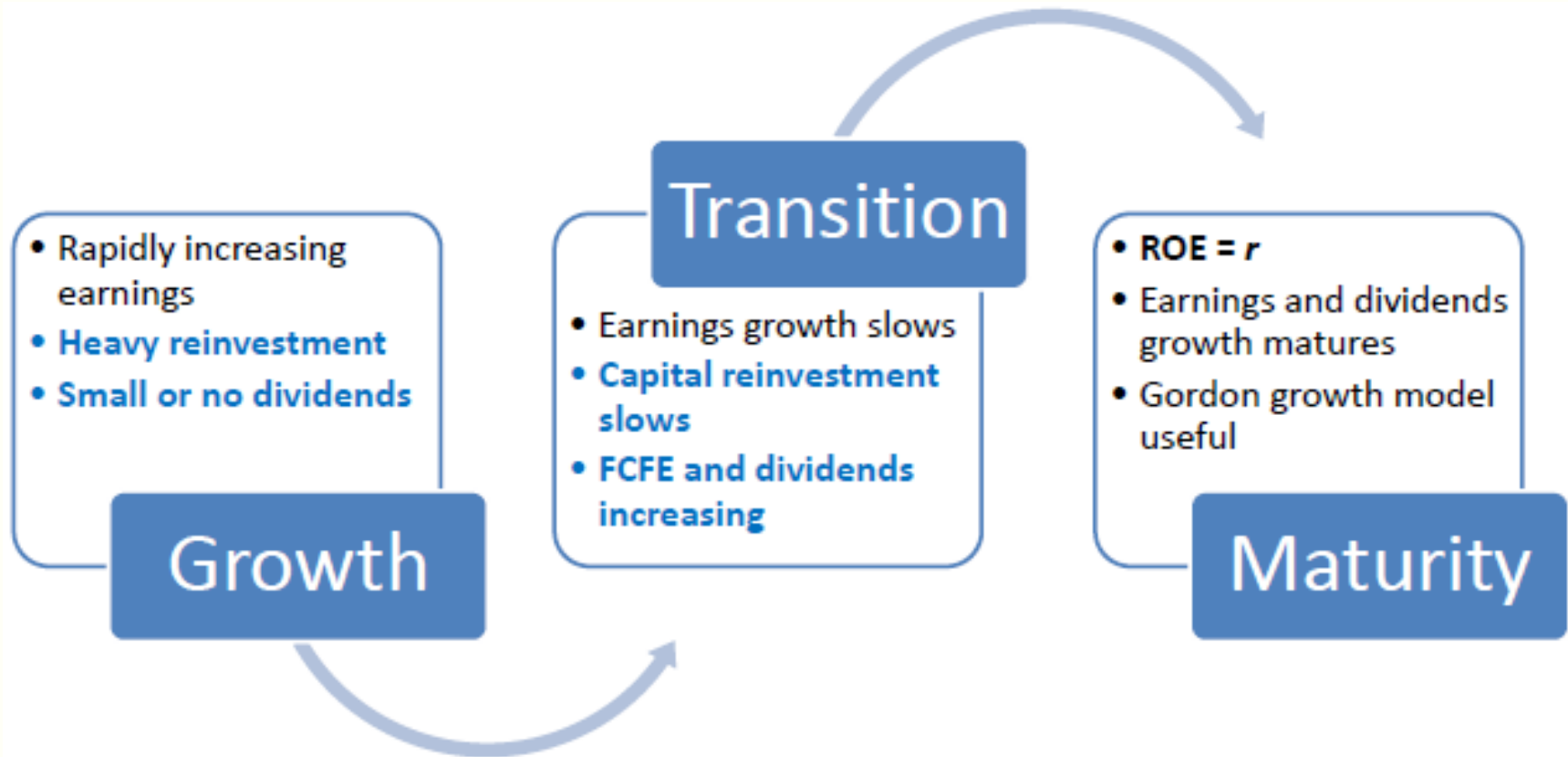
$$\text{Terminal Value}_n = D_1 / (k-g)$$

$g = \text{Retention ratio} \times \text{ROE}$

Terminal Value₀ = Terminal value_n / (1+k)ⁿ



Multiperiod DDM: Choice of Discounted Cash Flow Models



Dividend displacement of earnings: The lower (higher) the retention ratio (b), the lower (higher) the dividend growth rate.

IV

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

- In the case where the extraordinary **growth rate (g)** and **dividend payout 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

Source: Equity Asset Valuation, 3rd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons



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, 3rd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons



Example: Two-stage DDM (cont.)

Time	Value	Calculation	D_t or V_t	Present Values
				$D_t/(1.12)^t$ or $V_t/(1.12)^t$
1	D_1	$1.00(1.30)$	1.30	1.161
2	D_2	$1.00(1.30)^2$	1.69	1.347
3	D_3	$1.00(1.30)^3$	2.197	1.564
4	D_4	$1.00(1.30)^4$	2.856	1.815
5	D_5	$1.00(1.30)^5$	3.713	2.107
6	D_6	$1.00(1.30)^6$	4.827	2.445
6	V_6	$1.00(1.30)^6(1.06) / (0.12 - 0.06)$	85.273	43.202
Total				53.641

Source: Equity Asset Valuation, 3rd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons



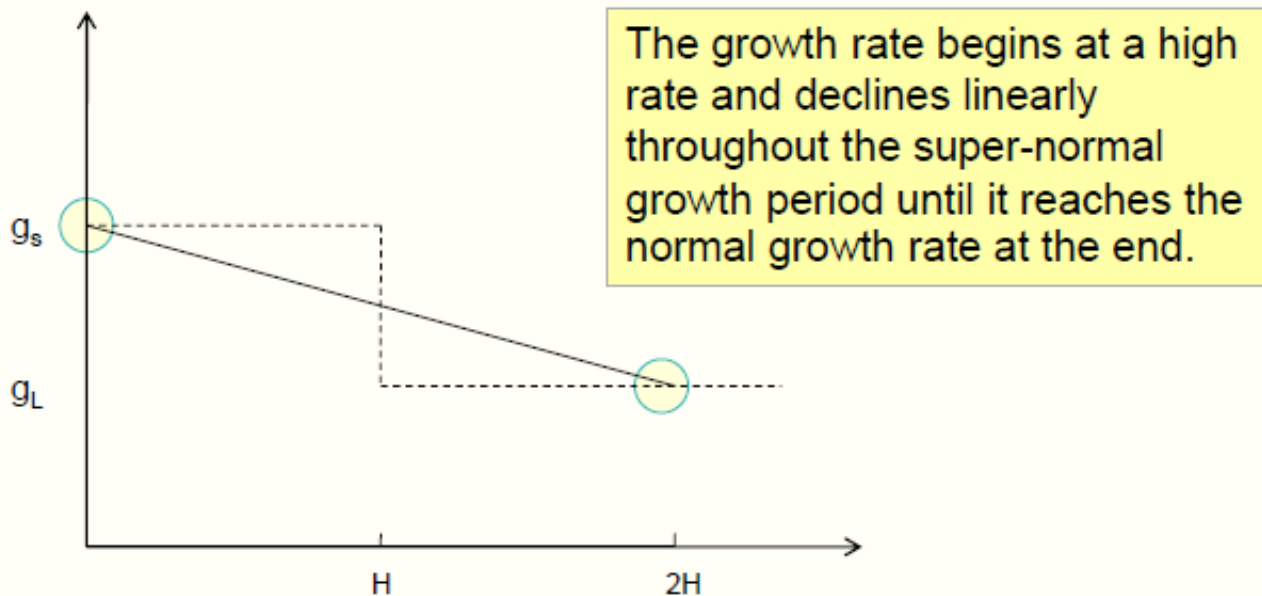
Limitations of the Two-Stage Model

- The first practical problem is in **defining the length of the extraordinary growth period.**
- The second problem 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 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 shifting growth rates.



The H-Model: The Value of Growth

$$V_0 = \frac{[D_0 \times (1 + g_L)] + [D_0 \times H (g_S - g_L)]}{r - g_L}$$

V_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 = $2H$)

$$r = \left\{ \left(\frac{D_0}{P_0} \right) \left[(1 + g_L) + H \times (g_S - g_L) \right] \right\} + g_L$$

Source: Equity Asset Valuation, 3rd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons



Example: The H Model

- 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%.

$$P_0 = \frac{D_0(1+g_L)}{r-g_L} + \frac{D_0H(g_S-g_L)}{r-g_L}$$

- 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**.



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.



Limitations of the DDM

- 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 particular, firms that **accumulate cash and pay out too little in dividends.**



The Stable Growth Rate

There are insights worth keeping in mind when estimating a **stable growth rate (sustainable growth rate)**:

- Firm's **other measures of performance can also be expected to grow at the same rate as the growth rate in dividend.**
- **The stable growth rate (g) should be less than or equal to the growth rate of the economy (as a proxy, the risk-free rate).**
- 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. (the rule of thumb that the beta should be between 0.8 and 1.2).



WHY?



VI Issues in Using the DDM: Sensitivity to the Growth Rate

- 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.

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



VI Issues in Using the DDM: Tax Disadvantages from High-Dividend Stocks

- Portfolios created with the dividend discount model are generally characterized by high dividend yield, which **can create a tax disadvantage if dividends are taxed at a rate greater than capital gains** or if there is a substantial tax timing liability associated with dividends.
- Since the **excess returns uncovered in the studies presented earlier are pretax to the investor**, the introduction of personal taxes may significantly reduce or even eliminate these excess returns.

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)

Group Project



The General Version of DDM

OISHI: DDM

Fair value (Bt)	132
Share price (8-Feb-17)	137.50
Expected return (%)	-3.9%
CAGR of DPS 2017-21	23.0%
SGR 2022	8.0%
ke (%)	13.10%

Example of valuation

		0	1	2	3	4	5		
Bt	2014	2015	2016E	2017E	2018E	2019E	2020E	2021E	2022E
EPS	2.80	3.80	6.76	8.45	10.39	12.47	14.72	16.92	18.28
DPS	1.60	1.45	3.00	3.80	4.68	5.61	7.36	8.46	9.14
% DPS growth		-9.4%	106.9%	26.7%	23.0%	20.0%	31.1%	15.0%	8.0%
% Payout ratio	57%	38%	44%	45%	45%	45%	50%	50%	50%
% ROE	15.4%	19.6%	31.2%	33.2%	34.5%	34.8%	34.5%	33.8%	31.3%
PV of DPS				3.80	4.14	4.39	5.09	5.17	4.94
Terminal value									193.53
PV of terminal value									104.58
Fair value				132					

- What is the industry growth and profitability (ROIC, ROE)? [life cycle, Porter's five forces]
- Do you expect the company to grow at a higher rate or enjoy higher profitability than the industry? What sources of competitiveness (i.e competitive behavior)?
- If you expect the firm's growth and ROE to sustain at a rate higher than the industry, what are the reasons? [length of product life cycle, persistence of competitive advantage (brand, quality, market leader), products renewal]

