Equity Securities

TOPIC 7: DIVIDEND DISCOUNT VALUATION

Student learning outcomes

7.1 Compare and contrast dividends, free cash flow and residual income as alternative measures in discounted cash flow models, and identify the investment situations for which each is suitable;

7.2 Calculate the value of a common stock using the Gordon growth model, and explain the model's underlying assumptions;

7.3 Explain the strengths and limitations of the Gordon growth model, and justify its selection to value a company's common shares;

Student learning outcomes

7.4 Explain the assumptions and justify the selection of the two-stage DDM, the H-model, the three-stage DDM, or spreadsheet modeling to value a company's common shares;

7.5 Explain the growth phase, transitional phase and maturity phase of a business;

7.6 Explain terminal value, and discuss alternative approaches to determining the terminal value in a DDM;

7.7 Calculate and interpret the value of common shares using the two-stage DDM, the H-model, and the three-stage DDM;

Student learning outcomes

7.8 Evaluate whether a stock is overvalued, fairly valued or undervalued by the market based on a DDM estimate of value.

References

- **Pinto J.E., E. Henry, T.R. Robinson and D.D. Stowe. (2010).** Equity Asset Valuation. (2nd edition) John Wiley & Sons: New Jersey. Chapter 3.

Introduction

- The basic principle of valuation in finance is that the value of a security is the present value of all future cash flows
- Discounted cash flow (DCF) models are a fundamental tool on investment management and investment research
- The three most common definitions of cash flow used in DCF models are:
  - Dividends
  - Free cash flow
  - Residual income
- We will be looking at each of these DCF models in Topics 7, 8 and 10

Outcome 7.1

Dividend Discount Model (DDM)

- The circumstances in which a DDM is most suitable include:
  - The company is dividend-paying (i.e. the analyst has a dividend record to analyse)
  - The board of directors has established a dividend policy that bears an understandable and consistent relationship to the company's profitability, and
  - The investor takes a non-control position

Outcome 7.2

Holding period return

- If an investor wishes to buy a share today and hold it for one year, the value of that share today is the present value of the expected dividend to be received on the stock plus the present value of the expected selling price in one year's time

$$V_0 = \frac{D_1}{(1+r)} + \frac{P_1}{(1+r)} = \frac{D_1 + P_1}{(1+r)}$$

where
- V_0 = the value of the share of stock today, at $t = 0$
- P_1 = the expected price of the share in one year, at $t = 1$
- D_1 = the expected DPS for Year 1, paid at year end
- r = the required rate of return on the stock

Outcome 7.2

Holding period return

- If we assume that the current price, P_0, of the share is fairly valued and equal to V_0, the expected holding period return equals the sum of the expected dividend yield (D_1/P_0) and the expected change in the price of the stock [$(P_1 - P_0)/P_0$]

$$r = \frac{D_1 + P_1}{P_0} - 1 = \frac{D_1}{P_0} + \frac{P_1 - P_0}{P_0} = \frac{D_1}{P_0} + g_1$$

where
- P_0 = the price of the share in one year, at $t = 1$

Outcome 7.2

Holding period return

- If an investor plans to hold a stock for two years, the value of the stock is the present value of the expected dividend in Year 1, plus the present value of the expected dividend in Year 2, plus the present value of the expected selling price at the end of Year 2

$$V_0 = \frac{D_1}{(1+r)} + \frac{D_2}{(1+r)^2} + \frac{P_2}{(1+r)^2}$$

- Generalised over n periods, the DDM formula becomes:

$$V_0 = \sum_{t=1}^{n} \frac{D_t}{(1+r)^t} + \frac{P_n}{(1+r)^n}$$

Outcome 7.2

Holding period return

- For the next 5 years the annual dividends of a stock are estimated to be \$2.00, \$2.10, \$2.20, \$3.50 and \$3.75. The stock price is expected to be \$40.00 in 5 years. The cost of equity is estimated to be 10%.
- **Calculate the value of the stock**

Outcome 7.2

Dividend discount model

- As we increase the holding period by one year we have an extra dividend term in the expression; hence if we let the holding period extend into an indefinite future, the stock's value is the present value of all expected dividends

$$V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t}$$

- In order to solve this problem in practice, we can simplify it by characterising dividends according to one of three growth patterns
  - Constant growth forever (the Gordon Growth Model)
  - Two-stage growth model and the H-model
  - Three-stage growth model

Outcome 7.2

Gordon Growth Model

- The GGM assumes dividends grow at a constant rate, and hence:

$$D_1 = D_0(1+g)$$

- Applying the GGM's assumptions indefinitely to the DDM:

$$V_0 = \frac{D_0(1+g)}{(1+r)} + \frac{D_0(1+g)^2}{(1+r)^2} + \ldots + \frac{D_0(1+g)^n}{(1+r)^n} + \ldots$$

- Simplified algebraically, the GGM may be expressed as:

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

where
- g = the forecast constant rate of growth of dividends
- $g < r$

Outcome 7.2

Gordon Growth Model

- An annual dividend has just been paid equal to $5. The expected long-term growth rate is 5% and the cost of equity is 8%.
- **Calculate the value of the stock using the GGM**

Outcome 7.2

Gordon Growth Model

- The required rate of return on J.C. Penney (JCP) is estimated to be 8.8% using a CAPM model. On examination you consider that a long-term growth rate of 6% is achievable by JCP. JCP's current dividend is $0.50.
- **Calculate the value of the JCP using the GGM and state whether you think it is undervalued or overvalued if the market price is $25.**

Outcome 7.2

Gordon Growth Model

- You wish to estimate a value for Connecticut Water Service (CTWS)
  - The company has an ROE of approximately 12.2% p.a.
  - Actual FY2001 and estimated FY2002 EPS are $1.27 and $1.33 respectively
  - The current dividend is $0.81 and estimated FY2002 dividend is $0.83
  - You forecast the payout ratio to average 70% in future
  - You anticipate a 3.7% long-term dividend growth rate, and a GDP growth rate of 4.0%
  - Its current market price is $30.00.
- **Calculate the value of CTWS using the GGM, based on an estimated cost of equity of 6.2%**
- **Justify your selection of the GGM for valuing CTWS.**

Outcome 7.2

Gordon Growth Model

- **CTWS's beta is -0.16. Calculate the CAPM estimate of its cost of equity, assuming an equity risk premium of 5.7% and a risk-free rate of 5.7%.**

Outcome 7.2

Gordon Growth Model

- **Recalculate the value of CTWS based on the CAPM estimate of its cost of equity.**
- **Comment on the plausibility of your valuation assuming a P/E of 24 x FY2002 EPS is reasonable.**

Outcome 7.2

Gordon Growth Model

- **Recalculate the value of CTWS based on a cost of equity ranging through 5.95%, 6.20% and 6.45%, and a long-term growth estimate ranging through 3.45%, 3.70% and 3.95%.**
- **Assess the sensitivity of the valuation to changes in inputs.**

Outcome 7.3

Gordon Growth Model

- **The GGM is most suitable for the valuation of stocks when:**
  - The company meets the criteria applicable to companies for which the application of a DDM is suitable – i.e.
    - The company is paying dividends
    - There is a clear dividend policy that shows a consistent and understandable relationship between dividends and profitability
    - The investor has a non-control position
  - The company is forecast to produce a constant dividend stream
  - The required rate of return is greater than the estimated growth rate
  - The estimated growth rate is not significantly different from the growth rate of the overall economy

Outcome 7.3

Gordon Growth Model

- **Strengths**
  - Useful for valuing stable-growth, dividend-paying stocks
  - Useful for valuing broad-based indices
  - A clear model which helps in understanding the relationship between value and growth, required rate of return and payout ratio
  - Provides an approach to estimating the required rate of return
  - Can be incorporated into more complex dividend discount models
- Weaknesses
  - Valuation is very sensitive to assumed growth and cost of equity
  - Not applicable to non-dividend-paying stocks, or stocks which pay a dividend but which are expected to experience unstable growth

Outcome 7.5

Stylised business phases

- **Growth phase**
  - Rapidly expanding markets
  - High profit margins lead to an abnormally high growth rate in EPS
  - Often accompanied by negative free cash flow & low pay-out ratios
- **Transition phase**
  - Increasing competition attracted by high growth rates
  - Reduced prices and margins and declining growth towards the economy growth rate
  - Often positive free cash flow & increasing pay-out ratios
- **Mature phase**
  - In equilibrium, investments just earn their cost of capital
  - ROE approaches the cost of equity
  - Growth and pay-out ratios stabilise at sustainable long term levels

Outcome 7.4

Multi-stage models

- **Two-stage model**
  - Constant growth rate in each stage
  - Typically abnormal growth in stage one followed by normal growth rate, consistent with GDP growth, in stage two
- **H-model**
  - Stage one exhibits the rate of growth declining from an abnormal rate, followed by a constant growth rate in stage two
- **Three-stage model** (two popular versions)
  - Constant growth rates in all stages
  - Abnormally high growth in stage one and normal in stage three
  - In one version, stage two has a constant transitional growth rate
  - In the other version, stage two exhibits a growth rate declining from the stage one growth rate to the stage three growth rate

Outcome 7.4

Multi-stage models

- **Two-stage model**
  - Appropriate for companies that exhibit abnormal growth for a period; e.g. because they hold a patent, have first mover advantage or enjoy some other short-term competitive advantage, before the growth rate falls to a sustainable level
- **H-model**
  - Appropriate as an approximation of the two-stage model
- **Three-stage model**
  - Appropriate where stage two is expected to continue for a significant period of time, or where there is a large difference between the high growth rate and the normal long-term growth rate

Outcome 7.4

Two-stage DDM

- The model provides for two dividend growth rates:
  - A high growth rate, g_S, for the initial period,
  - Followed by a sustainable, lower growth rate thereafter, g_L
- The model provides a valuation which is equal to the sum of two present values:
  - Stage one: the sum of the present values of a stream of dividends growing at g_S
  - Stage two: the present value (at time 0) of the value of the asset at time n – the commencement of stage two – which is estimated using a GGM
  - The first dividend in the GGM, D_{n+1}, is estimated as follows:

$$D_{n+1} = D_0(1+g_S)^n(1+g_L)$$

Outcome 7.7

Two-stage DDM

- The valuation of a security using a two-stage model equals the sum of the present value of the first n dividends and the present value of the projected value at time n

$$V_0 = \sum_{t=1}^{n} \frac{D_0(1+g_S)^t}{(1+r)^t} + \frac{D_0(1+g_S)^n(1+g_L)}{(1+r)^n(r-g_L)}$$

where
- D_0 = the current dividend
- g_S = the estimated dividend growth rate in stage one
- g_L = the estimated dividend growth rate in stage two
- r = the required rate of return on the stock

Outcome 7.7

Two-stage DDM

- General Mills (GIS) is a large manufacturer and distributor of packaged consumer products. A buy-side analyst has studied GIS's growth prospects and estimates the current dividend of $1.10 will grow at 11% p.a. for the next 5 years and thereafter at 8% p.a.
- The analyst feels that his beta estimate for GIS is unreliable, so he is using the bond yield plus risk premium to estimate the required return. They YTM of GIS's long-term bond is 6.7% and he estimates a risk premium of 4%.

- **Calculate GIS's value based on a two-stage DDM.**

Outcome 7.7

Two-stage DDM

- A technology company is currently paying no dividends and will not pay a dividend until 5 years from now, when it expects to pay $1.00 in dividends
- It forecasts dividends to grow at a rate of 5% thereafter
- You estimate the company's required rate of return at 11%

- **Calculate the company's value based on a two-stage DDM.**

Outcome 7.7

H-model DDM

- The valuation of a security using a H-model equals the sum of the value of the company if it were to grow at the normal long-term growth rate, g_L, forever and an adjustment for the extra value accruing to the stock due to its supernormal, albeit declining, growth in stage one

$$V_0 = \frac{D_0(1+g_L)}{r-g_L} + \frac{D_0H(g_S-g_L)}{(r-g_L)}$$

where
- D_0 = the current dividend
- g_S = the estimated dividend growth rate in stage one
- g_L = the estimated dividend growth rate in stage two
- r = the required rate of return on the stock
- H = the half-life in years of stage one (i.e. stage 1 length = 2 x H)

Outcome 7.7

H-model DDM

- You are valuing Siemens AG (SIE) using a H-model DDM.
- The current dividend is $1.00 and its estimated growth rate is 29.98% p.a., declining linearly over a 16-year period to a final and perpetual growth rate of 7.26% p.a.
- The risk-free rate is 5.34%, the market risk premium is 5.32% and SIE's beta, estimated against the DAX, is 1.37.

- **Calculate SIE's value based on the H-model DDM.**

Outcome 7.7

Three-stage DDM

- There are two versions of the three-stage model
- In Version 1, each of the three stages has a distinct, yet constant, dividend growth rate

$$V_0 = \sum_{t=1}^{n} \frac{D_0(1+g_1)^t}{(1+r)^t} + \sum_{t=1}^{m} \frac{D_0(1+g_1)^n(1+g_2)^t}{(1+r)^{n+t}} + \frac{D_0(1+g_1)^n(1+g_2)^m(1+g_3)}{(1+r)^{n+m}(r-g_3)}$$

where

- n = the length of stage one
- m = the length of stage two
- g_1, g_2 and g_3 are the respective growth rates

Outcome 7.7

Three-stage DDM

- In Version 2 of the three-stage DDM, stage one and stage 3 have distinct yet constant growth rates, whereas stage two has a growth rate declining linearly from the stage one growth rate to the stage 3 growth rate

$$V_0 = \sum_{t=1}^{n} \frac{D_0(1+g_1)^t}{(1+r)^t} + \left\{ \frac{1}{(1+r)^n} \left[\frac{D_n(1+g_L)}{r-g_L} + \frac{D_n H(g_S - g_L)}{r-g_L} \right] \right\}$$

where H = the half-life of stage two

- In effect, we find the present value of the dividends in state 1, and then stages 2 and 3 are being valued as a H-model, beginning at time n, and then discounted to a present value

Outcome 7.7

Three-stage DDM

- IBM currently pays a dividend of $0.55 p.a.
- We estimate the current required rate of return is 12%
- Assume that dividends will grow at 7.5% p.a. for the next two years, 13.5% p.a. for the following four years and 11.25% thereafter into perpetuity

- **Calculate IBM's value based on the three-stage DDM.**

Outcome 7.7

Three-stage DDM

- You are valuing HRL using a three-stage DDM model, with a linearly declining dividend growth rate in the second state
- The current DPS is $0.39
- The required rate of return on HRL is estimated to be 8.72%
- Stage one dividend growth is estimated to be 11.3% p.a. for five years
- Stage two dividend growth will decline linearly over ten years, starting at the stage one rate and ending at the stage three rate
- The equilibrium long-term dividend growth rate is estimated to be 5.7% p.a.

- **Calculate HRL's value based on the three-stage DDM.**

Outcome 7.6

Terminal value

- The second stage in the valuation of a two-stage DDM, being an infinite stream of dividends growing at a constant rate, may be characterised by a terminal value of the stock as at the commencement of that stage and may be estimated by either:
  - A GGM valuation model
  - A market valuation model

Outcome 7.6

Terminal value

- In the past year DuPont (DD) paid a $1.40 dividend that analysts expect to grow at 9.3% p.a. for next 4 years
- At the end of year 4, analysts expect the payout ratio to be 40% and the trailing P/E for DD to be 11x
- The estimated required rate of return on DD is 11.5%

- **Calculate DD's value based on a two-stage DDM, using a P/E multiple to calculate the terminal value in stage 2**

Outcome 7.4

Multi-stage DDM

- **Strengths**
  - Can accommodate wide variety of dividend streams
  - The expected rate of return can be imputed by finding the discount rate that equates the present value of the dividend stream and the current price of the stock
  - Spreadsheets expand the number of complexity of DDM models
  - The models force analysts to specify and reflect on their assumptions, rather than relying on subjective judgements
- Weaknesses
  - Valuations are very sensitive to the inputs to the model
  - Programming and data errors in spreadsheets are common

Outcome 7.7

Multi-stage DDM

- Dell Computers (DELL) is expected to grow its EPS at 25% p.a. for the next 10 years, but will reinvest all of these earnings and not pay a dividend
- After ten years you estimate Dell's ratios will revert to industry averages; i.e. a margin of 4.5%, turnover of 1.5x, and leverage of 2.0x
- You also believe that as a mature company it will need to offer a dividend pay-out ratio of 15%
- DELL's trailing EPS is $0.76 and its beta is 1.45. The risk-free rate is 5.0% and the equity risk premium is 5.7%

- **Calculate a value for DELL based on an appropriate DDM valuation model**