AEM 2240: Finance for Dyson Majors

Equity Valuation: Discounted Cash Flow Approach

Equity Valuation

Assumptions underlying equity analysis and valuation:

1. Some stocks, sometimes, are mispriced (i.e., *markets are not fully efficient*)
2. When a stock is mispriced, the stock price will eventually approach its "true value" (a.k.a. *intrinsic value* or *fundamental value*).

If both assumptions are met and you are capable of identifying mispriced securities, then you can make money analyzing/valuing equity securities!

Efficient Market Hypothesis:

"A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. Formally, the market is said to be efficient with respect to some information set Ωt if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to an information set Ωt implies that it is impossible to make economic profits by trading on the basis of Ωt." (Malkiel 1992)

The content of the information set leads to three forms of the EMH:

1. Weak-form Efficiency: information set includes only history of prices or returns themselves
2. Semistrong-form Efficiency: information set includes all information known to all stock market participants (i.e., publicly available information)
3. Strong-form Efficiency: information set includes all information known to any market participant (i.e., private information)

Market Efficiency Paradox

What makes markets efficient?

- Theory predicts that the action of arbitrageurs would induce efficiency. If stock prices are misaligned, the actions of arbitrageurs will bring them close to their intrinsic values.
- But are markets fully efficient? It is not clear.

Market Efficiency Paradox (Grossman-Stiglitz Paradox)

- *Financial markets cannot be informationally efficient if information is costly (i.e., there is a cost to generating and/or gathering information).*

Logic is as follows:

- If markets are truly efficient and reflect all available private information perfectly, then there are no incentives to collect private information because all information can be obtained from publicly available signals (i.e., the market price)
- But, if all market participants stopped doing research/gathering information about future stock values:
  - Prices would not reveal private information
  - Markets would no longer be efficient

Equity: Models

How to proceed? We need to gather information and use it to determine the intrinsic value of a stock, where *intrinsic value = PV of stock's future cash flows using the appropriate discount rate*.

Commonly used models:

Q6: Over the last 12 months, how often have you used the following valuation techniques in your work? (Practitioner - solid / *Academic - italics*)

	Frequently	Infrequently	Never
Earning multiples	74%	23%	3%
	*54% ***	*33%*	*13% ***
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We will cover this later.

We will cover this first.

This is based on a recent survey among 201 practitioners (those practicing finance) and 63 academics (hopefully conducting research, but some just talking about stuff).

Equity: Dividend Discount Model (DDM)

Let us try to understand the intuition behind the Dividend Discount Model (DDM) as a framework to value equity securities.

The formulas you're about to see are very similar to the ones introduced in the Time Value of Money notes, but the notation is a little different…

Notation:

P_t: Price of stock at t (ex-dividend)

D_t: Cash dividend at t

$\mathrm{E}_t[\cdot]$: Expectation (forecast) at t

r_t: Risk-adjusted discount rate for cash flow at t.

Let's assume that $r_t = r$, i.e., the required rate of return for all horizons ("maturities") is the same and constant over time.

Equity: Dividend Discount Model (DDM)

Derivation of DDM:

Stock price at $t = 0$ reflects:

- Value of dividend at $t = 1$, D_1
- Value of stock after dividend at $t = 1$, P_1

$$P_0 = \frac{\mathrm{E}_0[D_1]}{1+r} + \frac{\mathrm{E}_0[P_1]}{1+r}.$$

What determines P_1?

$$P_1 = \frac{\mathrm{E}_1[D_2]}{1+r} + \frac{\mathrm{E}_1[P_2]}{1+r}.$$

$$\begin{aligned} P_0 &= \frac{\mathrm{E}_0[D_1]}{1+r} + \frac{1}{1+r}\left(\frac{\mathrm{E}_0[D_2] + \mathrm{E}_0[P_2]}{1+r}\right) \\ &= \frac{\mathrm{E}_0[D_1]}{1+r} + \frac{\mathrm{E}_0[D_2]}{(1+r)^2} + \frac{\mathrm{E}_0[P_2]}{(1+r)^2} \end{aligned}$$

↓ You can continue this forever:

$$= \frac{\mathrm{E}_0[D_1]}{1+r} + \frac{\mathrm{E}_0[D_2]}{(1+r)^2} + \frac{\mathrm{E}_0[D_3]}{(1+r)^3} + \frac{\mathrm{E}_0[P_3]}{(1+r)^3}$$

$$= \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r)^t} + \lim_{T\to\infty} \frac{\mathrm{E}_0[P_T]}{(1+r)^T}$$

$$P_0 = \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r)^t} \quad \text{if} \quad \lim_{T\to\infty} \frac{\mathrm{E}_0[P_T]}{(1+r)^T} = 0$$

"Basic DDM"

Equity: Dividend Discount Model (DDM)

What's the point of doing all this derivation?

You can now see that to figure out how much a stock is worth today, you "only" need to determine two things: (1) the stock's future dividend payments and (2) the required rate of return.

Let's begin with <u>future dividend payments</u>.

$$P_0 = \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r)^t}.$$ ←

<u>Modeling Cash Flows (three commonly used "shortcuts")</u>:

- Assume that dividends do not grow.
- Assume that dividends grow at a constant rate *g* in perpetuity.
- Assume that dividends grow at different rates in different stages.

Equity: Dividend Discount Model (DDM)

$$P_0 = \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r)^t}.$$ ←

<u>Modeling Cash Flows (three commonly used "shortcuts")</u>:

- **Assume that dividends do not grow.**
- Assume that dividends grow at a constant rate *g* in perpetuity.
- Assume that dividends grow at different rates in different stages.

→ $P_{i,t} = \frac{E(D_{i,t+1})}{r_i}$ (zero dividend growth model)

Equity: Dividend Discount Model (DDM)

$$P_0 = \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r)^t}.$$ ←

Modeling Cash Flows (three commonly used "shortcuts"):

- Assume that dividends do not grow.
- **Assume that dividends grow at a constant rate *g* in perpetuity.**
- Assume that dividends grow at different rates in different stages.

→ $P_{i,t} = \frac{E(D_{i,t+1})}{r_i - g_i}$ (constant dividend growth model)

Note: The growing perpetuity formula only makes sense if g<r. If dividends grew forever faster than (or equal to) the rate at which they are discounted, then P_0 would equal infinity!!

Equity: Dividend Discount Model (DDM)

For simplicity, let's suppose dividends are paid annually

1. Suppose firm X just paid an annual dividend of $1 per share. Let's say you expect the annual dividend to be $1 per share forever. The market's required rate of return on this stock is 10%.
   What should the price of the stock be today (t=0)?

2. Suppose firm Y just paid its annual dividend. Let's say you expect next year's dividend to be $1 per share, and you expect dividends to grow at a constant rate of 5% thereafter. The required rate of return is 10%.
   What should the price of the stock be today?

Equity: Dividend Discount Model (DDM)

A CFA exam question:

Dividend Discount Model (LO1, CFA3) Assume that at the end of the next year, Company A will pay a $2.00 dividend per share, an increase from the current dividend of $1.50 per share. After that, the dividend is expected to increase at a constant rate of 5 percent. If you require a 12 percent return on the stock, what is the value of the stock?

a. $28.57
b. $28.79
c. $30.00
d. $31.78

Equity: Dividend Discount Model (DDM)

$$P_0 = \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r)^t}.$$

Modeling Cash Flows (three commonly used "shortcuts"):

- Assume that dividends do not grow.

- Assume that dividends grow at a constant rate *g* in perpetuity.

- **Assume that dividends grow at different rates in different stages.**

Equity: Dividend Discount Model (DDM)

Firms often evolve through different stages in its growth. For example, some have three stages during their lifetime:

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.

Equity: Dividend Discount Model (DDM)

We need to estimate the length of time that the firm is expected to be in each stage and we need to estimate the respective growth rate for each stage.

→ Compute the present value of the cash flows in the three stages and add them up.

$$P_o = \sum_{stage1} \frac{E(D_t)}{(1+r)^t} + \sum_{stage2} \frac{E(D_t)}{(1+r)^t} + \sum_{stage3} \frac{E(D_t)}{(1+r)^t}$$

Equity: Dividend Discount Model (DDM)

Another CFA question:

Multiple Growth Rates (LO1, CFA7) Leisure Lodge Corporation is expected to pay the following dividends over the next four years: $15.00, $10.00, $5.00, $2.20. Afterwards, the company pledges to maintain a constant 4 percent growth rate in dividends forever. If the required return on the stock is 12 percent, what is the current share price?

Equity: DDM - Implementation

Implementation Issues:

-You need estimates for the required rate of return.

Some possibilities:

-Past returns of the stock in question.

-Past returns of other similar stocks.

-Past returns of the overall stock market.

-CAPM or some other factor model.

Equity: DDM - Implementation

Implementation Issues:

-You need estimates for dividend growth.

Some possibilities:

- Past dividend growth of the stock in question.
- Past dividend growth of other similar stocks.
- Past dividend growth of the overall stock market.
- A combination of these (e.g., You think that over the next three years, dividends are going to grow as much as they have in the past three years. After that, you think dividends are going to grow as much as they have in the past for other comparable firms in the same industry.).
- Information on return-on-equity and how much the company re-invests.

Equity: DDM - Case Study

Example: AXP (American Express) was trading at $173.61 (closing price) on Jan 4, 2022.

Past dividends-per-share:

Year	Dividends	Dividend Growth
2003	$0.38	
2004	$0.32	-15.79%
2005	$7.64	2287.50%
2006	$0.54	-92.93%
2007	$0.60	11.11%
2008	$0.72	20.00%
2009	$0.72	0.00%
2010	$0.72	0.00%
2011	$0.72	0.00%
2012	$0.78	8.33%
2013	$0.86	10.26%
2014	$0.98	13.95%
2015	$1.10	12.24%
2016	$1.19	8.18%
2017	$1.31	10.08%
2018	$1.44	9.92%
2019	$1.60	11.11%
2020	$1.72	7.50%
2021	$1.72	0.00%

Other companies in the financial services industry have experienced a dividend growth of ~10%.

Let's say that the required rate of return for AXP is 14%. Was AXP mispriced in your view?

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Equity: Discounted Free Cash Flow Model

Two concepts is **free cash flow to equity holders (FCFE)** and (total) **free cash flow (FCF)**

Difference between dividends and FCFE: former is based on actual cash paid out to shareholders, whereas latter is based on *potential cash* that *could* be paid out to shareholders.

Sometimes, there is a difference because rather than re-invest the money that is not being paid out in the form of dividends, management just adds that money to the firm's cash balance as a safety cushion.

If FCFE is very different from dividends, you should discount the FCFE to estimate the value of equity.

FCF is the potential cash that could be paid out to *both shareholders and debtholders*.
If you discount FCFs by the "weighted average cost of capital," you arrive at an estimate for the value of the total firm (equity portion + debt portion).
To get an estimate for the value of equity, simply subtract the value of debt from the total value of the firm and add back any cash the firm is holding (as the cash can be used to pay off debtholders). → Note: You will learn more about this in Corporate Finance