Chapter 2
Dividend-Based Valuation

Abstract Dividend discount models for equity valuation are a popular tool in the analysis of corporations and their financials. By using dividends as the target cash flow for the calculation of the present values, one directly aims at the equity value. The simplest forms of DDM rely on the discount of a perpetuity, by assuming the company will pay a constant dividend overtime, during its life. When the perpetuity allows for a constant growth rate of dividends overtime, it translate into the Gordon Growth model, which represents the value of the corporate equity as the present value of a growing perpetuity. Most of the multi-stage DDM are in fact designed to allow for an initial period of discrete cash flows to be discounted at the appropriate rate, and be summed up with the present value of a final perpetuity calculated on the residual dividend after the discrete period.

Keywords Dividends · Permanent growth · Perpetuity · Premium · Risk-free rate · Multiple stages · Efficiency

Dividends are the most straightforward type of cash flows produced by a company as a consequence of profitable investments. It therefore comes natural to adopt valuation models based on dividends.

The Dividend Discount Models are a powerful tool to discern the intrinsic value of the company based on the corporate payout policy, and the size and structure of the payments.

Either based on constant or growing dividends, all the models presented in this chapter share the practicality of application and the accessible level of the math required to perform them.

Depending on the number of stages considered for the model, the formulas change but the sense of the analysis does not. Dividends still represent a good base to start from for corporate valuation.

After studying this chapter, you will be able to answer the following questions, among others:

1. How can dividends be used for value calculation?
2. How can the model parameters be estimated?

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3. What is the role of the growth of dividends over time?
4. What are the main drivers of the dividend payout decision and how does it relate to value calculation?
5. What are the different models available for dividend-discount valuation?

The first section of the chapter introduces the dividend-based discount modelling of corporate value. The second section is about the Gordon growth dividend discount model and its application to growing dividends overtime. The third section focuses on multiple-stage models where a discrete initial growth period is combined with an infinite growing period in perpetuity. The final section deals with considerations about the use of dividend discount models and further issues related to market efficiency.

2.1 Dividend Discount Models

All Dividend Discount Models (DDMs) are based on the discounting of a stream of future dividend payments, in order to calculate a present value that represents the value of the corporate equity.

Another important variable in the DDM models is the return on equity (cost of equity), the demanded return from an investor seeking to invest in the company. It is the compensation that the investor claims in exchange of the capital inflow.

It is therefore very important to address the cost of equity and be able to calculate it. According to the Capital Asset Pricing Model, the return on equity can be calculated by using the formula

Recall that the CML describes the relationship between the excess return of an asset and the excess return of the market, as a line in the risk-return space.

$$r_i - r_f = \beta(r_m - r_f)$$

where

r_m is the return of the market.
β is the dependence factor between market and asset.

Once the cost of equity is calculated it can be used to discount the cash flows represented by the dividends. A popular method in the class of the DDMs is the dividend growth model (DGM), that measures the stock price and capital to be raised by using the information about the dividends paid out to shareholders by the company.

$$P_0 = \frac{D_0(1+g)}{r_e - g} \quad (2.1)$$

where

D_0 is the current dividend
g is the expected dividend future growth rate
r_e is the cost of equity.

As can be observed, the equation aims to predict the ex-dividend market price of the share by processing the dividend today, the expected future dividend growth and the appropriate cost of equity.

The numerator indicates the expected dividend in one period, due to the growth g. It is possible to rework Eq. (2.1) in order to isolate the cost of equity. When the current price of the equity (stock) is known, the model can then be used to estimate the cost of equity, and this model can take into account the dividend growth rate.

$$r_e = \frac{D_0(1+g)}{P_0} + g$$

Since all the terms on the right hand side are known at time zero, for a listed company, the calculation of the cost of equity is straightforward. When other information is not available, the future dividend growth is assumed to continue at the recent historical rate.

Example 2.1 The management of company ABC decides to pay a dividend of €1.75 on a stock with market price equal to €23.75 (cum-dividend). The historical dividend growth rate, which is expected to continue in the future, is 2.25%. Using the information it's possible to calculate the return on equity as

$$r_e = \frac{1.75(1+0.0225)}{23.75} + 0.0225 = 0.0978 = 9.78\%$$

One way to make the calculation more accurate is to use the ex-dividend price of the stock, obtained by subtracting the coming dividend from the cum-dividend price of the stock.

Example 2.2 Following the previous example, the ex-dividend price is given by

$$P_{0,Ex} = 23.75 - 1.75 = €22.00$$

The cost of equity is, therefore given by:

$$r_e = \frac{1.75(1+0.0225)}{22.00} + 0.0225 = 0.1038 = 10.38\%$$

Stock valuation is based on the general assumption that if a market is populated by rational investors, the value of the stock today represents the present value of all future cash flows to be accrued in the future.

The rules of time travel allow to discount back all dividends in time and sum them up to a present value, so obtaining the price today of the stock. This is the intrinsic value of the stock, calculated on the basis of all available information.

The expectation of the investor who takes a long position on a stock is usually to get two types of cash flow in return. The first type is an income cash flow represented by the dividends paid out during the time span of the investment.

On top of that the investor can realize a capital gain by selling the stock back to the market when the price is convenient for that, and make a profit on the price difference compared to the buying price.

Since this expected price is itself determined by future dividends, the value of a stock is the present value of dividends through infinity.

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

where,

D_t is the expected dividends per share
r_e is the cost of equity

Expected dividends and the return on equity are the two main components of the model, where the former are obtained through making assumptions about the expected future growth rates in earning and payout ratios.

About the cost of equity, it depends on how the asset is risky and it is normally measured with pricing model like the Capital Asset Pricing Model (CAPM), or other types of linear multivariate models.

The model is flexible enough to allow for time-varying discount rates, where the time variation is caused by expected changes in interest rates or risk across time.

The issue with projecting future dividends is complicated because it is not possible to make such a projection through infinity. Therefore, several versions of the dividend discount model are available, making different assumptions about future growth.

2.2 The Gordon Growth Model

The Gordon Growth Dividend Model (GGDM) is a model designed to be very simple and immediate. It values stocks in the framework of stable growth, for a company paying as much as it can in dividends.

The model can be used to value a firm that is in 'steady state' with dividends growing at a rate that can be sustained forever, and relates the value of a stock to its expected dividends in the next time period, the cost of equity and the expected growth rate in dividends.

$$P_0 = \frac{D_1}{r_e - g}$$

where,

D_1 is the dividend expected in the next period.

The meaning of a stable growth rate is a rate that spans on the company's dividends forever. The two insights in estimating such a rate also include the fact that all other financial figures are expected to grow at the same rate.

It is in fact the case that, when the dividends grow at a higher rate than the whole company and its earnings, the dividends will exceed the earnings over time. If the opposite holds, and the earnings grow at a higher rate than dividends, the latter will then converge towards zero, which is different from a steady state. In order for a company to grow at a steady state, the expected growth rate should be substituted in, so as to get exactly the same result for dividends growth and firm's growth.

There is also an issue related to how to judge whether a growth rate can be considered reasonable for a stable growth. The rule of thumb is that the growth rate has to be less than or equal to the growth rate of the economy in which the firm operates.

The agreement among analysts is not unanimous and the rate to be adopted in this case is controversial. Academicians however normally agree that there are three fundamental reasons for a company to be in a steady state.

Expected inflation is normally governed by a fair degree of uncertainty, making a difference in the real growth of the economy. With different expectations about the level of prices, there could be different projections about the growth rate of a country.

The growth rate of the company can be much less than the growth rate of the overall economy, and in some cases the firms become smaller over time, in proportion to the economy.

There is a final consideration regarding the fact that when a company is seen to be growing at a little bit more than a stable growth rate, for a few years continuously, then it is appropriate to assess the value of the firm by adding a premium to the stable growth rate. In the assumption of a non-stable growth of the company, then the analysis should be carried on in multiple stages.

In practice, no firm matches the assumption of constant growth rate, and earnings are normally quite volatile over the years. Anyway it is still possible to apply the model when the earnings show some constancy over cyclical periods.

Thus, a cyclical firm that can be expected to have year-to-year swings in growth rates, but has an average growth rate that which is defined, can be valued using the Gordon growth model, without a significant loss of generality.

A usual practice of companies is to smooth dividends over time. This is an argument in favour of the above theory and the fact that dividends are not linked to the cyclicality of earnings.

From the mathematical point of view, an average growth rate gives results that are not very different from ones obtained by using a constant growth rate. It is therefore possible to state the value of the stock as the present value of dividends per share paid in perpetuity, under the assumption that dividends are paid forever, as

$$P_0 = \frac{D_1^*}{r_e}$$

where

D_1^* is the constant dividend per share expected from the next period.

The cost of equity that discounts the dividend in perpetuity is equivalent to the time value of the capital that is invested. It also reflects the risk of the investment.

The return and the maturity of the investment are directly related and the longer the money is tied, the higher the required return will be. The latter also is a consequence of the risk associated with the investment, due to the uncertainty about the future cash flows.

Example 2.3 Assume a stock paying a current dividend of €1.75 per share and a required rate of return of 10.5%. The value of a share of stock is therefore

$$P_0 = \frac{1.75}{0.105} = €16.67$$

Therefore, by paying €16.67 per share and assuming constant future dividends of €1.75 per share, the investor will earn a 10.5% return per year on the investment every year.

If the assumption of a constant growth of the dividend over time is made, it is possible to factorize the amount of dividend D_1 at time 1 into the dividend at time zero multiplied by the growth factor.

In this case the value of the common stock at present is given by discounting an amount of infinite dividends growing at a constant rate g. The obvious way to perform such a calculation is through a growing perpetuity. The specific case of dividends growing at the constant rate g is commonly referred to as the dividend valuation model (DVM):

$$P_0 = \frac{D_0(1+g)}{r_e - g} = \frac{D_1}{r_e - g}$$

This model is also referred to as the Gordon model and it is one of a general class of models referred to as the dividend discount model (DDM).

Example 2.4 Astock pays a current dividend of €1.75 and the dividends per share are expected to grow at a rate of 2.25% per year. If the required rate of return (cost of equity) is 10.5% in perpetuity, the value of the share is

$$P_0 = \frac{1.75(1 + 0.0225)}{0.105 - 0.0225} = €21.69$$

If the growth is not expected to be constant, but rather growing over time, as it happens in real cases, the model changes. Companies normally experience seasonalities and cyclicalities that make the growth rate change over time.

Normally companies experience initial rapid growth when they start, a decreased growth in the intermediate phase of operations, and a situation of declining growth in their final stage. Further, companies may experience changes in their growth due to acquisitions and divestitures.

2.3 Multiple-Stage Growth Model

It is possible to modify the Dividend Growth model in order to allow for a two-stage representation. The model is then defined by an initial phase of unstable growth, with subsequent steady state, when the growth becomes constant.

Such a model incorporates the benefits of a careful distinction between the initial growth of the company in its early years, and a growth that applies in the long term. Moreover, the model can be adapted to cases where the firm is expected to post low or even negative growth rates for a few years and then revert back to stable growth.

The initial stage of the model is built on a growth rate that lasts for a set number T of years. After that, the company is assumed to have reached a steady state, and it is possible to model the growth through a perpetuity on the value of future dividends. The value of the stock according to the model is given by

$$\begin{aligned} P_0 &= \sum_{t=1}^{T} \frac{D_t}{1 + r_e^*} + \frac{P_T}{\left(1 + r_e^*\right)^T} \\ &= \sum_{t=1}^{T} \frac{D_t}{1 + r_e^*} + \left[\frac{1}{\left(1 + r_e^*\right)^T} \times \frac{D_{T+1}}{(r_e - g)}\right] \end{aligned} \tag{2.2}$$

where

r_e^* is the cost of equity in the high growth stage
r_e is the cost of equity in the stable growth stage

If the initial growth is stable, and the dividend payout ratio is stable too over the n years of extraordinary growth, Eq. (2.2) can be simplified as

$$P_0 = \frac{D_0(1 + g^*)\left[1 - \frac{(1+g^*)^T}{\left(1+r_e^*\right)^T}\right]}{\left(r_e^* - g^*\right)} + \frac{D_{T+1}}{(r_e - g)(1 + r_e)^T}$$

where

g^* is the growth in the high growth stage

Example 2.5 Ashare of common stock currently pays a dividend of €1.75 per share and is expected to grow at a rate of 2.25% per year for 2 years and at a rate of 1.75% per year afterwards. The required rate of return is 10.05%. The stock price can be calculated as

$$P_0 = \left[\frac{1.75(1.0225)}{1+0.105} + \frac{1.75(1.0225)^2}{(1+0.105)^2}\right] + \frac{P_2}{(1+0.105)^2}$$

The term P_2 is calculated as

$$P_2 = \frac{1.75(1.0225)^2(1.0175)}{0.105-0.0175} = €21.28$$

so that

$$P_0 = 1.619 + 1.498 + 17.43 = €20.55$$

The resulting model is very similar to the standard Dividend valuation model, with the difference that in the former case the price obtained is the minimum after which the company experiences constant growth, while in the latter the dividends in the first growth phase are instead discounted using basic cash flow discounting.

It is possible to extend the model to a three-stage formula, by allowing for an initial period of growth, a transitional period where growth declines and a final stable growth phase. It is the most general of the models because it does not impose any restrictions on the payout ratio.

The high growth in stage one is normally higher than classical stable growth, and it is followed by declining rate in the second stage, to then stabilize again at a constant growth rate in the final stage.

The value of the stock is given by discounting the expected dividends during the high growth and the transitional periods, plus the terminal price at the start of the final stable growth phase.

$$P_0 = \sum_{t=1}^{T_1} \frac{EPS_0(1+g_{HG})^t \theta_{HG}}{(1+r_{HG})^t} + \sum_{t=1}^{T_2} \frac{DPS_0}{(1+r_{TR})^t} + \frac{EPS_{T_2}(1+g_{SG})^t \theta_{SG}}{(r_{SG}-g_{SG})(1+r_f)^t}$$

where

EPS_0 are the earnings per share in year t
DPS_t are the dividends per share in year t
g_{HG} is the growth rate in high growth phase, lasting T_1 years
g_{SG} is the growth rate in stable phase

θ_{HG} is the payout ratio in high growth phase
θ_{SG} is the payout ratio in stable growth phase
r_{HG} is the cost of equity in high growth phase
r_{TR} is the cost of equity in transition phase
r_{SG} is the cost of equity in stable growth phase

As opposed to other DDMs this is much more flexible, with the downturn of requiring more inputs to run. Thus there is a trade-off between flexibility and higher noise in the estimation of the values due to possible errors in the inputs.

Companies experiencing a real three-stage growth process during their life are quite common. Most companies go through a development stage with high growth, a maturing phase with moderate growth, and a declining phase with little, no, or negative growth.

The application of a three-stage dividend discount model is less easy than classical dividend discount models, and it entails six steps, as we can see from the following example.

Consider the valuation of a stock that has a current dividend of €3.00 per share. Dividends are expected to grow at a rate of 12% for the next five years. Following that, the dividends are expected to grow at a rate of 8% for five years.

After ten years, the dividends are expected to grow at a rate of 3% per year, forever. If the required rate of return is 15%, it is possible to calculate the value of the stock by breaking the calculation into six steps.

First of all, the dividends for the years from 1 to 11 must be calculated as

Year	Dividend growth rate (%)	Dividend
1	12	3.360
2	12	3.763
3	12	4.215
4	12	4.721
5	12	5.287
6	8	5.710
7	8	6.167
8	8	6.660
9	8	7.193
10	8	7.768
11	3	8.001

Year	Dividend	Present value
1	3.36	2922
2	3.763	2845
3	4.215	2771
4	4.721	2699
5	5.287	2629

(continued)

(continued)

Year	Dividend	Present value
6	5.71	2469
7	6.167	2318
8	6.66	2177
9	7.193	2045
10	7.768	1920
11	8.001	1720

Present value of dividends after year 10 can be calculated as the present value of a growing perpetuity

$$PV_{\infty} = \frac{8.001}{0.15 - 0.03} = €66.67$$

The discounted value at time zero of the growing perpetuity is then given by

$$PV_0 = \frac{66.675}{(1 + 0.15)^{10}} = €16.48$$

The sum of the present value of the dividends in the first 10 years is given by

$$PV_{10} = \sum_{t=1}^{10} \frac{DIV_t}{(1 + 0.15)^t} = €24.79$$

The value of the stock at present is given by the sum of the present value of the growing perpetuity and the present value of the dividends in the first 10 years, as for

$$PV_{\infty} = 16.48 + 24.79 = €41.27$$

It is possible to compare the model to the CAPM in order to grasp the differences among them. The dividend growth model gives a measure of cost of equity through the analysis of empirical data publicly available for most companies.

The calculation comes straight through an algorithm that involves measuring the dividends, estimating the dividend growth, copying the market value of the shares, and using the amounts in the equation to estimate the cost of equity.

The model is however limited in that it does not give any information about why different shares have different costs of equity. This is due to the fact that dividend growth models ignore the risk aspect of valuation.

That model simply measures what’s there without offering an explanation. Note particularly that a business cannot alter its cost of equity by changing its dividends. The equation:

$$r_e = \frac{D_0(1+g)}{P_0} + g$$

might suggest that the rate of return would be lowered if the company reduced its dividends or the growth rate.

The reality is different, and normally a dividend cut or growth decrease would result in a lower market value of the company. The value would decrease until the level corresponding to the point where investors obtain the required return.

The CAPM is a more complete model, making a step further by introducing systematic (market) risk in the equation for valuation. Other returns in the economy as well as the relationship among the various risks translate into beta and asset return.

Another important feature of CAPM is to offer several ways to measure the inputs, as the risk-free rate, the market return and the beta. They can be estimated from empirical data, or are normally available as public information.

2.4 Dividend Valuation Models and Market Efficiency

The dividend discount model class provides a framework to relate the value of the company to the fundamental features of the business. An example of this relationship is the association between the company's stock's price-to earnings ratio to fundamental factor.

The price-earnings ratio is the ratio of the price per share to the earnings per share of a stock. We can relate this ratio to the company's dividend payout, expected growth, and the required rate of return.

An interesting formula is obtained by taking the DVM equation and dividing both sides by earnings per share. This expresses the price to earnings ratio in terms of dividend payout, required rate of return, and growth, as

$$\frac{P_0}{X_0} = \frac{\frac{D_0}{X_0}(1+g)}{r-g}$$

where

P_0 is the current stock price
X_0 is the earnings per share
D_0 is the current dividend per share
g is the expected dividend growth rate
r is the required rate of return (cost of equity)
$\frac{D_0}{X_0}$ is the dividend payout ratio

The above equation gives important information regarding the relationship between the payout ratio and the price to book equity (PE) ratio. In particular it is clear that the PE ratio is directly related to the dividend payout, inversely related to the cost of equity and directly related to the growth rate of dividends.

It is also possible to rearrange the model to solve for the required rate of return, by noting that

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

The formula tells that the required rate of return is composed by the dividend yield and the growth rate of dividends over time, which can be considered as a form of capital gain.

Another way to use the dividend valuation model is to relate the PE ratio to factors such as the dividend payout ratio and the return on equity. Initially one must substitute for the dividend payout ratio in the dividend discount model, so as to obtain

$$P_0 = \frac{D_0(1+g)}{r-g} = \frac{X_0\left(\frac{D_0}{X_0}\right)(1+g)}{r-g}$$

The formula, after manipulation, becomes

$$P_0 = \frac{E_0 \times ROE_0\left(\frac{D_0}{X_0}\right)(1+g)}{r-g}$$

where

E_0 is the current book value of equity
ROE_0 is the current return on equity

It is then possible to relate the price of a stock to book value, the return on equity, the dividend payout, the required rate of return, and the growth rate. In particular the value of the stock increases when the book value of equity, ROE and growth rate of dividends increases. On the other hand the value decreases when the rate of return applied to discount the dividends increases.

The dividend discount model can in conclusion be used, along with our knowledge of financial relations (i.e., financial statements and financial ratios), to relate the stock's price and price multiples to fundamental factors.

Stock valuation models are based on the belief that the investors will act rationally by paying as a price for a stock the present value of the benefits expected to be gained in the future.

But in reality stock valuation is not so simple, because reality shows that dividends are not paid constantly, nor do they grow at a constant rate for most companies. The model doesn't apply in the case when dividends do not grow at a constant rate (or at least in stages) or in the case when the company does not pay dividends.

Those cases must be handled with the use of other models, based on other types of cash flows, as shown in the following chapters of this book. When valuing investments, the analyst wants to estimate the future cash flows from these investments and then discount these to the present.

The logic behind this process is that no one will pay more than logically expected as a fair price on any investment. In an efficient market this means that the price today reflects all available information.

The information itself relates to the amount of future cash flows and the risk associated to them. As the market is hit by new pieces of information, the stock price will change according to the reaction of the investors.

In terms of valuation, the more complex the information and valuation of the information, the more time it takes for the market to digest the information and the stock to be properly valued.

For well established companies the new pieces of information will display their effect in about fifteen minutes, so that the normal individual investor will never be quick enough to benefit from the changes.

Technical analysis will therefore be useless, and fundamental analysis, while valuable in terms of evaluating future cash flows, assessing risk, and assisting in the proper selection of investments for a portfolio, will simply produce returns commensurate with the risk assumed.

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