Dividend Discount Model (DDM)

Suppose we forecast dividends for the coming five years and use an option to close the valuation model. We may do this because we expect either high growth or low growth for the next five years, then some kind of sustainable dividend or growth occurs.

\[
Value = \left[ \frac{D_1}{(1 + k_1)} + \frac{D_2}{(1 + k_2)^2} + \frac{D_3}{(1 + k_3)^3} + \frac{D_4}{(1 + k_4)^4} + \frac{D_5}{(1 + k_5)^5} \right] + \cdots
\]

\(D\)'s represent annual dividend payments either in per share terms (DPS) or in total. If in per share terms then the value is in per share as well. If, instead, \(D\)'s represent total dividend then value represents total equity value – but, in order to get to per share value simply divided by the number of shares outstanding.

\(k\)'s represent the “cost of capital”. Specially, the \(k\)'s for us represent the cost of “equity” capital. It merely means the appropriate discount rate in our case. The terminology may sound strange but gets widely used. A further complication arises with the terminology because “cost of capital” may – and very often does - refer to the “Weighted Average Cost of Capital” or WACC. This is the appropriate discount rate to value an entire firm. The WACC gets used in corporate finance as a hurdle rate – that is, the rate that any investment project must beat in order to be justified. [don’t worry, you don’t need to know this for this class]

\[
WACC = \frac{D}{V} i(1-t) + \frac{C}{V} k + \frac{F}{V} r_F
\]

where

- \(D\) is the Market Value of Debt
- \(C\) is the Market Value of Common Stock
- \(F\) is the Market Value of Preferred Stock
- \(V\) is the Total Market Value
- \(i\) is the yield to maturity (or, cost of debt)
- \(t\) is the tax rate
- \(k\) is the cost of common equity
- \(r_F\) is the cost of preferred stock

Returning to the DDM and before we get to the options for closing the valuation model, consider what we need to forecast. Instead of forecasting dividends, let’s forecast earnings (to do dividends you’d have to forecast earnings anyway).
Dividends = (Dividend Payout Ratio) x Earnings

Or, in per share terms

DPS = (Dividend Payout Ratio) x EPS

Thus, in per share terms

$Value = \left[ \frac{b_1 \times EPS_1}{(1 + k_1)} + \frac{b_2 \times EPS_2}{(1 + k_2)} + \frac{b_3 \times EPS_3}{(1 + k_3)} + \frac{b_4 \times EPS_4}{(1 + k_4)} + \frac{b_5 \times EPS_5}{(1 + k_5)} \right] + \ldots$

Where $b$’s represent the payout ratios. That is, the fraction of earnings paid out to shareholders in the form of dividends.

Unlike most bonds, stocks (or, shares) represent ownership in a corporation and therefore have no maturity date. Thus, we need to make some assumption about what happens after our forecast periods. There are two standard ways to close the valuation model.

Option 1) Assume a constant annual dividend after the forecast period. This allows you to value those constant dividends as if they were like a consol (a bond that pays that makes the same payment forever).

$\frac{DPS}{k} = \frac{b \times EPS}{k}$

Now, here is the **WRONG** way to do this.

$Value = \left[ \frac{b_1 \times EPS_1}{(1 + k_1)} + \frac{b_2 \times EPS_2}{(1 + k_2)} + \frac{b_3 \times EPS_3}{(1 + k_3)} + \frac{b_4 \times EPS_4}{(1 + k_4)} + \frac{b_5 \times EPS_5}{(1 + k_5)} \right] + \frac{b \times EPS}{k}$

Why is this wrong?
The last term in the last equation provides the present value of the constant dividend in YEAR 5, not in the present year. So, we need to do the following.

$$Value = \left[ \frac{b_1 \times EPS_1}{(1 + k_1)^1} + \frac{b_2 \times EPS_2}{(1 + k_2)^2} + \frac{b_3 \times EPS_3}{(1 + k_3)^3} + \frac{b_4 \times EPS_4}{(1 + k_4)^4} + \frac{b_5 \times EPS_5}{(1 + k_5)^5} \right] + \frac{1}{(1 + k_5)^5} \times \frac{b \times EPS}{k}$$

The last term now gives us the present value (as of now) of a constant dividend paid annually forever beginning in year 6.

Option 2) The dividend grows at a constant rate after year 5. Here, we simply employ the Gordon Model to close the valuation.

$$\frac{D_6}{k - g} = \frac{b \times EPS_6}{k - SGE}$$

where SGE stands for the sustainable growth in earnings (sometimes labeled with some version of $g$). Again, this will give us the present value in YEAR 5 of the future dividends growing at a constant rate. Thus, we need to bring this terminal value back to the present.

$$Value = \left[ \frac{b_1 \times EPS_1}{(1 + k_1)^1} + \frac{b_2 \times EPS_2}{(1 + k_2)^2} + \frac{b_3 \times EPS_3}{(1 + k_3)^3} + \frac{b_4 \times EPS_4}{(1 + k_4)^4} + \frac{b_5 \times EPS_5}{(1 + k_5)^5} \right] + \frac{1}{(1 + k_5)^5} \times \frac{b \times EPS_6}{k - SGE}$$

So what do we need to forecast?
Input Variables

\[ EPS \] Specific EPS for the forecast period (in our case, the next five years), then the sustained EPS if option 1 for closure.

\[ b \] You will often see only one assumption about the payout ratio. However, this need not be the case. If you have reason to believe that the payout ratio will be changing, then you may want to forecast the specific payout ratios during the time period.

\[ k \] Again, you will often see one assumption made about the cost of capital. However, conceptually it makes much more sense to forecast these for each time period.

\[ SGE \] You’ll need to forecast a sustainable growth in earnings per share if you choose option 2 for closure.
Abnormal Earnings Model (AE Model)

\[
Value = BPS_0 + \left[ \frac{AE_1}{(1+k_1)^1} + \frac{AE_2}{(1+k_2)^2} + \frac{AE_3}{(1+k_3)^3} + \frac{AE_4}{(1+k_4)^4} + \frac{AE_5}{(1+k_5)^5} \right] + \text{???}
\]

where \( AE \) stands for abnormal earnings. Recall the definition of abnormal earnings,

\[
AE = \text{Actual EPS} - \text{Required EPS}
\]

The actual EPS is what we forecast, but note that this can be written in an alternative fashion.

Actual \( EPS = ROE \times BPS = \) Return on Equity (ROE) \( \times \) Book Value per Share

Why? Because of the definition of return on equity.

\[
ROE_i = \frac{EPS_i}{BPS_{i-1}} \rightarrow EPS_i = ROE_i \times BPS_{i-1}
\]

Thus, return on equity is the earnings per share made during the period divided by book value per share at the beginning of the period.

The Required \( EPS \) can be stated in a similar fashion, though this time with the required rate of return rather than the actual rate of return (or, \( ROE \)).

\[
\text{Required } EPS = k_i \times BPS_{i-1}
\]

Thus, our valuation model would be the following so far.
\[
Value = BPS_0 + \left[ \frac{(ROE_1 - k_1)BPS_0}{(1 + k_1)^1} + \frac{(ROE_2 - k_2)BPS_1}{(1 + k_2)^2} + \cdots + \frac{(ROE_5 - k_5)BPS_4}{(1 + k_5)^5} \right] + ???
\]

The closure options are similar to the dividend discount model (DDM).

Option 1) Assume constant abnormal earnings after year 5

\[
\frac{AE}{k} = \frac{(ROE - k)BPS}{k}
\]

Thus,

\[
Value = BPS_0 + \left[ \frac{(ROE_1 - k_1)BPS_0}{(1 + k_1)^1} + \frac{(ROE_2 - k_2)BPS_1}{(1 + k_2)^2} + \cdots + \frac{(ROE_5 - k_5)BPS_4}{(1 + k_5)^5} \right] + \frac{1}{(1 + k)^5} \times \frac{(ROE - k)BPS_5}{k}
\]

Option 2) Assume a constant growth in abnormal earnings after year 5

\[
Value = BPS_0 + \left[ \frac{(ROE_1 - k_1)BPS_0}{(1 + k_1)^1} + \frac{(ROE_2 - k_2)BPS_1}{(1 + k_2)^2} + \cdots + \frac{(ROE_5 - k_5)BPS_4}{(1 + k_5)^5} \right] + \frac{1}{(1 + k)^5} \times \frac{(ROE - k)BPS_5}{k - SGAE}
\]

where SGAE stands for sustainable growth in Abnormal Earnings.

So what do we need to forecast for this model?
Although there is one additional input variable, we actually do not have to forecast more variables. Why? Because compute the book value per share ($BPS$) from the forecasted earnings per share ($EPS$) and payout ratio ($b$). Recall the clean surplus identity.

\[ BPS_t = BPS_{t-1} + EPS_t \times (1 - b_t) \]

Hence, the forecasted variables are exactly the same at those used in the Dividend Discount Model (DDM). This result should not come as a surprise since the AE model is derived from the DDM.
Discounted Cash Flow Model (DCF Model)

The DCF model can be used to value an entire firm or just the equity in the firm. In the case of equity (thus, the value per share), FCFE represents the CASH earned during a period that could have been paid out to shareholders. Remember, the FCFE is NOT the same as earnings (or, net income).


Examples of differences between FCFE and Earnings:

- Not all Sales will be made in cash. When customers do not pay cash, the corporation records the transaction as an increase in sales revenue and an increase in Accounts Receivables (a short-term, or “current”, asset). Thus, there is no cash inflow and yet there is an increase in earning.

- Expenses may have been recorded because they were incurred, but no cash outflow occurred. For example, the corporation may purchase inventory on credit from its supplier. The inventory is recorded as an increase in assets and an increase in liabilities (specifically, accounts payable which is a short-term or “current” liability). When the corporation sells the inventory, they record the sales revenue and the cost of the goods sold (thus, what the inventory had cost them) in order to arrive at the earnings on that transaction. However, notice that since the inventory had been purchased on credit there was no cash outflow.

- Capital expenditures may represent large cash outflows without an immediate expense recorded.

- Depreciation is recorded as an expense, but no cash outflow occurs.

- When a corporation borrows money (e.g., bank loan, or bond), there is a cash inflow which does not show impact earnings. On the other hand, when a corporation makes cash payments towards the principal of a loan there is a cash outflow that doesn’t impact earnings either.
From Earnings to FCFE

$$\text{FCFE} = \text{Earnings}$$

- (Capital Expenditures – Depreciation)
- (Change in non-cash working capital)
+ (New Debt Issued – Debt Repayments)

Working Capital = Current Assets – Current Liabilities

Examples of Current Assets: Cash, Accounts Receivables, Inventory

Example of Current Liabilities: Accounts Payable

Thus, by looking at the change in non-cash working capital, we see what must have happened to cash.

Before considering the forecasting issue, let’s state the valuation model with the two options for closure (just like previous models).
Option 1) Assuming the FCFE remains constant after year 5

$$Value = \left[ \frac{FCFE_1}{(1 + k_1)^1} + \frac{FCFE_2}{(1 + k_2)^2} + \frac{FCFE_3}{(1 + k_3)^3} + \frac{FCFE_4}{(1 + k_4)^4} + \frac{FCFE_5}{(1 + k_5)^5} \right] + \frac{1}{(1 + k)^5} \times \frac{FCFE}{k}$$

Option 2) Assuming the FCFE grows at a constant rate after year 5

$$Value = \left[ \frac{FCFE_1}{(1 + k_1)^1} + \frac{FCFE_2}{(1 + k_2)^2} + \frac{FCFE_3}{(1 + k_3)^3} + \frac{FCFE_4}{(1 + k_4)^4} + \frac{FCFE_5}{(1 + k_5)^5} \right] + \frac{1}{(1 + k)^5} \times \frac{FCFE_6}{k - SGFC}$$

where SGFC stands for sustainable growth in free cash (flow to equity).

What do we need to forecast in order to use this model?
Input Variables (note you can either convert to per share at beginning or the end)

\[ k \]

\[ FCFE \]
- Earnings
- Capital Expenditures - Depreciation
- Change in non-cash working capital
- Debt Issued - Debt Repaid

\[ SGFC \]

Notice how many more variables must be forecasted using the DCF model. The big question of course is how to forecast the variables that go into the FCFE. If an analyst forecasts complete incomes statements and balance sheets then no problem exists. We could just read off the relevant variables from the forecasted statements.

There are some short-cuts to the forecasting. Accounting ratios can be of great help if we’re willing to forecast sales revenue instead of earnings directly --- in fact, it is a much better practice to use a sales forecast as a driver for forecasts. Once we have sales forecasts, then we can think of – for example – the fixed assets necessary to support those sales.

We might even be willing to consider forecasting based upon the earnings forecast. For example, we state the above variables as percentage of earnings. The real problem turns out to be the ‘lumpiness’ of some of the variables. Thus, capital expenditures might be huge in one year (e.g., built a factory) but then small for a few years. Further, debt issued might be large one year because they issued bonds, but then nothing for a few years. Thus, we might consider thinking of what happens over a particular time period – e.g., a five year average.
Comparables Method (or, Relative Valuation)

The comparables method – it’s not really a valuation ‘model’ – comes in a variety of forms, from the very simple to the more statistically sophisticated. It turns out to be widely used by market participants – possibly because of its ease. We’ll cover the two most widely used ways of performing this method.

1) Simple Relative Valuation

In this form, we simply identify a relative price we deem to be important and utilize the average in the market or specific sector. The relative price might be the price-earnings ratio (P/E), price-book ratio (P/B), or price-sales (P/S) ratio – all of these in per share terms.

For example, suppose we know the following.

1. Current Earnings per Share of General Mills is $4.25
2. Current Book Value per Share of General Mills is $16.53
3. Current Sales (Revenue) per Share of General Mills is $45.75
4. Average P/E for Processed & Packaged Goods is 15
5. Average P/B for Processed & Packaged Goods is 4
6. Average P/S for Processed & Packaged Goods is 1.5

We are using Processed & Packaged Goods as General Mills’ main operating industry – but note, one of the difficulties of this method turns out to be the comparison group itself, so be careful. Given this information, we might assume that General Mills is about an average type corporation within this comparison group and therefore should be valued accordingly. Hence, we can do a three quick valuations.

a. $Value_{GIS} = E_{GIS} \times \left( \frac{P}{E} \right)_{Average} = \$4.25 \times 15 = \$63.75$

b. $Value_{GIS} = B_{GIS} \times \left( \frac{P}{B} \right)_{Average} = \$16.53 \times 4 = \$66.12$

c. $Value_{GIS} = S_{GIS} \times \left( \frac{P}{S} \right)_{Average} = \$45.75 \times 1.5 = \$67.13$
Of course, if we believe that General Mills is a better than average corporation in this industry, then we could either adjust the valuation upward directly or use the valuation as a floor. Alternatively, if we believe that General Mills is not as good as the average then our valuation becomes a ceiling.

Which of the above three valuations is correct? That is one of the problems with this method. Whatever ratio you believe most accurately reflects value is the one that is correct. Of course, the ‘correct’ ratio to use could in fact differ between industries (consumer goods vs. services) and/or corporation (e.g., young vs. mature).

2) Relative Valuation using Regression Analysis

We can use the Gordon Model (or, Constant Growth Dividend Discount Model) to break-up the ratios in order to discover the variables that are driving them. Once we have done this, it is a matter of running a regression to discover just how much each of the independent variables influences the overall ratio. Let’s try this for General Mills. Here is the data we’ll need. Notice I haven’t used many comparable firms, if I were to do this again I’d probably use the more firms for better regression results.

<table>
<thead>
<tr>
<th>Ticker</th>
<th>P/E</th>
<th>P/S</th>
<th>P/B</th>
<th>Payout</th>
<th>Beta</th>
<th>Growth</th>
<th>ROE</th>
<th>Profit Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEP</td>
<td>18.340</td>
<td>2.231</td>
<td>6.124</td>
<td>0.541</td>
<td>0.570</td>
<td>10.500</td>
<td>33.376</td>
<td>12.261</td>
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<tr>
<td>GIS</td>
<td>15.384</td>
<td>1.453</td>
<td>3.933</td>
<td>0.442</td>
<td>0.300</td>
<td>9.070</td>
<td>25.244</td>
<td>9.832</td>
</tr>
<tr>
<td>K</td>
<td>16.165</td>
<td>1.530</td>
<td>9.819</td>
<td>0.481</td>
<td>0.540</td>
<td>10.050</td>
<td>53.488</td>
<td>9.478</td>
</tr>
<tr>
<td>CPB</td>
<td>15.588</td>
<td>1.459</td>
<td>15.005</td>
<td>0.486</td>
<td>0.320</td>
<td>9.100</td>
<td>71.554</td>
<td>9.702</td>
</tr>
<tr>
<td>CAG</td>
<td>13.671</td>
<td>0.748</td>
<td>1.973</td>
<td>0.512</td>
<td>0.790</td>
<td>7.670</td>
<td>14.749</td>
<td>5.555</td>
</tr>
<tr>
<td>SLE</td>
<td>22.239</td>
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<td>3.929</td>
<td>0.849</td>
<td>0.970</td>
<td>8.080</td>
<td>15.019</td>
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<tr>
<td>SJM</td>
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<td>1.516</td>
<td>1.238</td>
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<td>0.720</td>
<td>8.170</td>
<td>9.391</td>
<td>7.760</td>
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<td>1.427</td>
<td>3.362</td>
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<td>0.380</td>
<td>10.000</td>
<td>20.880</td>
<td>8.376</td>
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<tr>
<td>RAH</td>
<td>11.748</td>
<td>0.818</td>
<td>1.182</td>
<td>0.000</td>
<td>0.090</td>
<td>7.670</td>
<td>15.495</td>
<td>6.652</td>
</tr>
<tr>
<td>FLO</td>
<td>17.245</td>
<td>0.827</td>
<td>3.202</td>
<td>0.513</td>
<td>0.170</td>
<td>9.500</td>
<td>18.698</td>
<td>4.858</td>
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<td>CPO</td>
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<td>1.632</td>
<td>0.637</td>
<td>1.230</td>
<td>10.000</td>
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<td>1.776</td>
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<td>DLM</td>
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<td>1.270</td>
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<td>0.770</td>
<td>7.500</td>
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<td>LNCE</td>
<td>28.670</td>
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<td>0.380</td>
<td>15.000</td>
<td>12.243</td>
<td>3.397</td>
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<tr>
<td>DMND</td>
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<td>0.913</td>
<td>3.026</td>
<td>0.125</td>
<td>0.360</td>
<td>15.000</td>
<td>14.860</td>
<td>4.159</td>
</tr>
<tr>
<td>BGS</td>
<td>20.794</td>
<td>0.572</td>
<td>1.946</td>
<td>1.799</td>
<td>1.360</td>
<td>10.000</td>
<td>8.800</td>
<td>2.787</td>
</tr>
</tbody>
</table>
a. P/E Ratio

From the Gordon Model: \[ \frac{P}{E} = \frac{b}{k - g} \]

Thus, the payout ratio \( b \), expected growth in earnings \( g \), assuming a constant payout ratio, and discount rate (or, risk factor, we’ll use beta from CAPM as a proxy). After collecting the data and running the regression we get the following partial output.

<table>
<thead>
<tr>
<th></th>
<th>Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-5.30</td>
</tr>
<tr>
<td>Payout</td>
<td>-0.56</td>
</tr>
<tr>
<td>Beta</td>
<td>9.61</td>
</tr>
<tr>
<td>Growth</td>
<td>1.88</td>
</tr>
</tbody>
</table>

The coefficients tell us just how much the P/E ratio depends upon the variables. We translate the regression results into an equation that estimates the P/E ratio.

\[ \frac{P}{E} = -5.30 - 0.56 \times (\text{Payout}) + 9.61 \times (\text{Beta}) + 1.88 \times (\text{Growth}) \]

At this point, it is simply a matter of plugging in the relevant data for General Mills to get its predicted P/E ratio (or, in other words, what we believe its ratio should be).

\[ \left( \frac{P}{E} \right)_{GIS} = -5.30 - 0.56 \times (.442) + 9.61 \times (.3) + 1.88 \times (9.07) = 14.42 \]

Now, we can do precisely what we did before with the average P/E, but this time with our predicted P/E which takes into account the variables driving the ratio.
\[ Value_{GIS} = E_{GIS} \times \left( \frac{P}{E} \right)_{\text{Predicted}} = 4.25 \times 14.42 = 61.28 \]

We’ll quickly cover the next two ratios since it turns out to be the same procedure.

b. P/B ratio: \[ \frac{P}{B} = \frac{ROE \times b}{k - g} \]

<table>
<thead>
<tr>
<th>Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
</tr>
<tr>
<td>Payout</td>
</tr>
<tr>
<td>Beta</td>
</tr>
<tr>
<td>Growth</td>
</tr>
<tr>
<td>ROE</td>
</tr>
</tbody>
</table>

\[ \frac{P}{B} = -3.75 + .44 \times (Payout) + 1.11 \times (Beta) + .23 \times (Growth) + .21 \times (ROE) \]

\[ \frac{P}{B} = -3.75 + .44 \times (.442) + 1.11 \times (.30) + .23 \times (9.07) + .21 \times (25.25) = 4.2 \]

\[ Value_{GIS} = B_{GIS} \times \left( \frac{P}{B} \right)_{\text{Predicted}} = 16.53 \times 4.2 = 69.47 \]
c. $P/S = \frac{P}{S} = \frac{\text{Profit Margin} \times b(1 + g)}{k - g}$

<table>
<thead>
<tr>
<th>Coefficients</th>
<th></th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>Payout</td>
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</tr>
<tr>
<td>Beta</td>
<td>0.17</td>
</tr>
<tr>
<td>Growth</td>
<td>0.07</td>
</tr>
<tr>
<td>Profit Margin</td>
<td>0.16</td>
</tr>
</tbody>
</table>

\[
\frac{P}{S} = -0.84 + 0.10 \times (\text{Payout}) + 0.17 \times (\text{Beta}) + 0.07 \times (\text{Growth}) + 0.16 \times (\text{Profit Margin})
\]

\[
\frac{P}{S} = -0.87 + 0.10 \times (0.4442) + 0.17 \times (0.30) + 0.07 \times (9.07) + 0.16 \times (9.832) = 1.54
\]

\[
\text{Value}_{GIS} = S_{GIS} \times \left( \frac{P}{S} \right)_{\text{Predicted}} \quad = $45.75 \times 1.54 \quad = \$70.24
\]
Some Forecasting Suggestions

1) Historical data (for the corporation, and its competitors)

2) 10K filing provides useful information

3) Corporation’s conference calls

4) Forecasting the economy (e.g., Fed releases)

5) Overall market (e.g., Standard & Poors)

6) Consider shorter time periods (e.g., quarters rather than years)

7) Other analysts