CHAPTER 12

CLOSURE IN VALUATION: ESTIMATING TERMINAL VALUE

In the last chapter, we examined the determinants of expected growth. Firms that reinvest substantial portions of their earnings and earn high returns on these investments should be able to grow at high rates. But for how long? In this chapter, we bring closure to firm valuation by considering this question.

As a firm grows, it becomes more difficult for it to maintain high growth and it eventually will grow at a rate less than or equal to the growth rate of the economy in which it operates. This growth rate, labeled stable growth, can be sustained in perpetuity, allowing us to estimate the value of all cash flows beyond that point as a terminal value for a going concern. The key question that we confront is the estimation of when and how this transition to stable growth will occur for the firm that you are valuing. Will the growth rate drop abruptly at a point in time to a stable growth rate or will it occur more gradually over time? To answer these questions, we will look at a firm's size (relative to the market that it serves), its current growth rate and its competitive advantages.

We also consider an alternate route, which is that firms do not last forever and that they will be liquidated at some point in time in the future. We will consider how best to estimate liquidation value and when it makes more sense to use this approach rather than the going concern approach.

Closure in Valuation

Since you cannot estimate cash flows forever, you generally impose closure in discounted cash flow valuation by stopping your estimation of cash flows sometime in the future and then computing a terminal value that reflects the value of the firm at that point.

$$\text{Value of a Firm} = \sum_{t=1}^{t=n} \frac{\text{CF}_t}{(1+\text{k}_c)^t} + \frac{\text{Terminal Value}_n}{(1+\text{k}_c)^n}$$

You can find the terminal value in one of three ways. One is to assume a liquidation of the firm's assets in the terminal year and estimate what others would pay for the assets that the firm has accumulated at that point. The other two approaches value the firm as a going concern at the time of the terminal value estimation. One applies a multiple to earnings, revenues or book value to estimate the value in the terminal year. The other assumes that the cash flows of the firm will grow at a constant rate forever – a stable growth rate. With stable growth, the terminal value can be estimated using a perpetual growth model.

Liquidation Value

In some valuations, we can assume that the firm will cease operations at a point in time in the future and sell the assets it has accumulated to the highest bidders. The estimate that emerges is called a liquidation value. There are two ways in which the liquidation value can be estimated. One is to base it on the book value of the assets, adjusted for any inflation during the period. Thus, if the book value of assets ten years from now is expected to be $2 billion, the average age of the assets at that point is 5 years and the expected inflation rate is 3%, the expected liquidation value can be estimated.

$$\text{Expected Liquidation value} = \text{Book Value of Assets}_{\text{Term yr}}\,(1+\text{inflation rate})^{\text{Average life of assets}}$$

$$= \$\,2 \text{ billion } (1.03)^5 = \$2.319 \text{ billion}$$

The limitation of this approach is that it is based upon accounting book value and does not reflect the earning power of the assets.

The alternative approach is to estimate the value based upon the earning power of the assets. To make this estimate, we would first have to estimate the expected cash flows from the assets and then discount these cash flows back to the present, using an appropriate discount rate. In the example above, for instance, if we assumed that the assets in question could be expected to generate $400 million in after-tax cash flows for 15 years (after the terminal year) and the cost of capital was 10%, your estimate of the expected liquidation value would be:

$$\text{Expected Liquidation value} = (\$400\text{ million})\frac{\left(1-\frac{1}{(1.10)^{15}}\right)}{0.10} = \$3.042\text{ billion}$$

When valuing equity, there is one additional step that needs to be taken. The estimated value of debt outstanding in the terminal year has to be subtracted from the liquidation value to arrive at the liquidation proceeds for equity investors.

Multiple Approach

In this approach, the value of a firm in a future year is estimated by applying a multiple to the firm's earnings or revenues in that year. For instance, a firm with expected revenues of $6 billion ten years from now will have an estimated terminal value in that year of $12 billion if a value to sales multiple of 2 is used. If valuing equity, we use equity multiples such as price earnings ratios to arrive at the terminal value.

While this approach has the virtue of simplicity, the multiple has a huge effect on the final value and where it is obtained can be critical. If, as is common, the multiple is estimated by looking at how comparable firms in the business today are priced by the market. The valuation becomes a relative valuation rather than a discounted cash flow valuation. If the multiple is estimated using fundamentals, it converges on the stable growth model that will be described in the next section.

All in all, using multiples to estimate terminal value, when those multiples are estimated from comparable firms, results in a dangerous mix of relative and discounted cash flow valuation. While there are advantages to relative valuation, and we will consider these in a later chapter, a discounted cash flow valuation should provide you with an estimate of intrinsic value, not relative value. Consequently, the only consistent way of estimating terminal value in a discounted cash flow model is to use either a liquidation value or a stable growth model.

Stable Growth Model

In the liquidation value approach, we are assuming that your firm has a finite life and that it will be liquidated at the end of that life. Firms, however, can reinvest some of their cash flows back into new assets and extend their lives. If we assume that cash flows, beyond the terminal year, will grow at a constant rate forever, the terminal value can be estimated as.

$$\text{Terminal Value}_t = \frac{\text{Cash Flow}_{t+1}}{r - g_{stable}}$$

where the cash flow and the discount rate used will depend upon whether you are valuing the firm or valuing the equity. If we are valuing the equity, the terminal value of equity can be written as:

$$\text{Terminal value of Equity}_n = \frac{\text{Cashflow to Equity}_{n+1}}{\text{Cost of Equity}_{n+1} - g_n}$$

The cashflow to equity can be defined strictly as dividends (in the dividend discount model) or as free cashflow to equity. If valuing a firm, the terminal value can be written as:

$$\text{Terminal value}_n = \frac{\text{Cashflow to Firm}_{n+1}}{\text{Cost of Capital}_{n+1} - g_n}$$

where the cost of capital and the growth rate in the model are sustainable forever.

In this section, we will begin by considering how high a stable growth rate can be, how to best estimate when your firm will be a stable growth firm and what inputs need to be adjusted as a firm approaches stable growth.

Constraints on Stable Growth

Of all the inputs into a discounted cash flow valuation model, none can affect the value more than the stable growth rate. Part of the reason for it is that small changes in the stable growth rate can change the terminal value significantly and the effect gets larger as the growth rate approaches the discount rate used in the estimation. Not surprisingly, analysts often use it to alter the valuation to reflect their biases.

The fact that a stable growth rate is constant forever, however, puts strong constraints on how high it can be. Since no firm can grow forever at a rate higher than the growth rate of the economy in which it operates, the constant growth rate cannot be greater than the overall growth rate of the economy. In making a judgment on what the limits on stable growth rate are, we have to consider the following questions.

1. *Is the company constrained to operate as a domestic company or does it operate (or have the capacity) to operate multi-nationally?* If a firm is a purely domestic company, either because of internal constraints (such as those imposed by management) or external (such as those imposed by a government), the growth rate in the domestic economy will be the limiting value. If the company is a multi-national or has aspirations to be one, the growth rate in the global economy (or at least those parts of the globe that the firm operates in) will be the limiting value. Note that the difference will be small for a U.S. firm, since the U.S economy still

represents a large portion of the world economy. It may, however, mean that you could use a stable growth rate that is slightly higher (say 1/2 to 1%) for a Coca Cola than a Consolidated Edison.

2. *Is the valuation being done in nominal or real terms?* If the valuation is a nominal valuation, the stable growth rate should also be a nominal growth rate, i.e. include an expected inflation component. If the valuation is a real valuation, the stable growth rate will be constrained to be lower. Again, using Coca Cola as an example, the stable growth rate can be as high as 5.5% if the valuation is done in nominal U.S. dollars but only 3% if the valuation is done in real dollars.
3. *What currency is being used to estimate cash flows and discount rates in the valuation?* The limits on stable growth will vary depending upon what currency is used in the valuation. If a high-inflation currency is used to estimate cash flows and discount rates, the limits on stable growth will be much higher, since the expected inflation rate is added on to real growth. If a low-inflation currency is used to estimate cash flows, the limits on stable growth will be much lower. For instance, the stable growth rate that would be used to value Titan Cements, the Greek cement company, will be much higher if the valuation is done in drachmas than in euros.

While the stable growth rate cannot exceed the growth rate of the economy in which a firm operates, it can be lower. There is nothing that prevents us from assuming that mature firms will become a smaller part of the economy and it may, in fact, be the more reasonable assumption to make. Note that the growth rate of an economy reflects the contributions of both young, higher-growth firms and mature, stable growth firms. If the former grow at a rate much higher than the growth rate of the economy, the latter have to grow at a rate that is lower.

Setting the stable growth rate to be less than or equal to the growth rate of the economy is not only the consistent thing to do but it also ensures that the growth rate will be less than the discount rate. This is because of the relationship between the riskless rate that goes into the discount rate and the growth rate of the economy. Note that the riskless rate can be written as:

Nominal riskless rate = Real riskless rate + Expected inflation rate

In the long term, the real riskless rate will converge on the real growth rate of the economy and the nominal riskless rate will approach the nominal growth rate of the economy. In fact, a simple rule of thumb on the stable growth rate is that it should not exceed the riskless rate used in the valuation.

Can the stable growth rate be negative?

In the previous section, we noted that the stable growth rate has to be less than or equal to the growth rate of the economy. But can it be negative? There is no reason why not since the terminal value can still be estimated. For instance, a firm with $100 million in after-tax cash flows growing at –5% a year forever and a cost of capital of 10% has a value of:

$$\text{Value of firm} = \frac{100(1-0.05)}{0.10-(-0.05)} = \$633 \text{ million}$$

Intuitively, though, what does a negative growth rate imply? It essentially allows a firm to partially liquidate itself each year until it just about disappears. Thus, it is an intermediate choice between complete liquidation and the going concern that gets larger each year forever.

This may be the right choice to make when valuing firms in industries that are being phased out because of technological advances (such as the manufacturers of typewriters with the advent of the personal computer) or where an external and critical customer is scaling back purchases for the long term (as was the case with defense contractors after the end of the cold war).

Key Assumptions about Stable Growth

In every discounted cash flow valuation, there are three critical assumptions you need to make on stable growth. The first relates to when the firm that you are valuing will become a stable growth firm, if it is not one already. The second relates to what the characteristics of the firm will be in stable growth, in terms of return on investments and costs of equity and capital. The final assumption relates to how the firm that you are valuing will make the transition from high growth to stable growth.

I. Length of the High Growth Period

The question of how long a firm will be able to sustain high growth is perhaps one of the more difficult questions to answer in a valuation, but two points are worth making. One is that it is not a question of whether but when firms hit the stable growth wall. All firms ultimately become stable growth firms, in the best case, because high growth makes a firm larger and the firm's size will eventually become a barrier to further high growth. In the worst case scenario, firms may not survive and will be liquidated. The second is that high growth in valuation, or at least high growth that creates value[1], comes from firms earning excess returns on their marginal investments. In other words, increased value comes from firms having a return on capital that is well in excess of the cost of capital (or a return on equity that exceeds the cost of equity). Thus, when you assume that a firm will experience high growth for the next 5 or 10 years, you are also implicitly assuming that it will earn excess returns (over and above the required return) during that period. In a competitive market, these excess returns will eventually draw in new competitors and the excess returns will disappear.

You should look at three factors when considering how long a firm will be able to maintain high growth.

1. *Size of the firm*: Smaller firms are much more likely to earn excess returns and maintain these excess returns than otherwise similar larger firms. This is because they have more room to grow and a larger potential market. Small firms in large markets should have the potential for high growth (at least in revenues) over long periods. When looking at the size of the firm, you should look not only at its current market share, but also at the potential growth in the total market for its products or services. A firm may have a large market share of its current market, but it may be able to grow in spite of this because the entire market is growing rapidly
2. *Existing growth rate and excess returns:* Momentum does matter, when it comes to projecting growth. Firms that have been reporting rapidly growing revenues are more likely to see revenues grow rapidly at least in the near future. Firms that are

[1] Growth without excess returns will make a firm larger but not more valuable.

earnings high returns on capital and high excess returns in the current period are likely to sustain these excess returns for the next few years.

3. *Magnitude and Sustainability of Competitive Advantages*: This is perhaps the most critical determinant of the length of the high growth period. If there are significant barriers to entry and sustainable competitive advantages, firms can maintain high growth for longer periods. If, on the other hand, there are no or minor barriers to entry or if the firm's existing competitive advantages are fading, you should be far more conservative about allowing for long growth periods. The quality of existing management also influences growth. Some top managers[2] have the capacity to make the strategic choices that increase competitive advantages and create new ones.

Illustration 12.1: Length of High Growth Period

To illustrate the process of estimating the length of the high growth period, we will consider a number of companies and make subjective judgments about how long each one will be able to maintain high growth:

***Consolidated Edison*:**

Background: The firm has a monopoly in generating and selling power in the environs of New York. In return for the monopoly, though, the firm is restricted in both its investment policy and its pricing policy. A regulatory commission determines how much Con Ed can raise prices and it makes this decision based upon the returns made by Con Ed on its investments; if the firm is making high returns on its investments, it is unlikely to be allowed to increase prices. Finally, the demand for power in New York is stable as the population levels off.

Implication: The firm is already a stable growth firm. There is little potential for either high growth or excess returns.

Procter & Gamble

Background: Procter & Gamble comes in with some obvious strengths. Its valuable brand names have allowed it to earn high excess returns (as manifested in its high return on equity of 29.37% in 2000) and sustain high growth rates in earnings over the last few decades. The firm faces two challenges. One is that it has a significant market share in a mature market in the United States and that its brand names are less recognized outside of the United States and therefore less likely to command premiums abroad. The other is the increasing assault on brand names in general by generic manufacturers.

Implication: Brand name can sustain excess returns and growth higher than the stable growth rate for a short period – we will assume five years. Beyond that, we will assume that the firm will be in stable growth albeit with some residual excess returns. If the firm is able to take its brand names overseas, its potential for high growth in terms of rate and period will be significantly higher.

Amgen

Background: Amgen has a stable of drugs, on which it has patent protection, that generates cash flows currently and several drugs in its R&D pipeline. While it is the largest biotechnology firm in the world, the market for bio-technology products is expanding significantly and will continue to do so. Finally, Amgen has had a track record of delivering high earnings growth.

Implication: The patents that Amgen has will protect it from competition and the long lead time to drug approval will ensure that new products will take a while getting to the market. We will allow for ten years of high growth and excess returns. There is clearly a strong subjective component to making a judgment on how long high growth will last. Much of what was said about the interrelationships between qualitative variables and growth towards the end of Chapter 11 has relevance for this discussion as well.

Competitive Advantage Period (CAP)

The confluence of high growth and excess returns which is the source of value has led to the coining of the term "competitive advantage period" (CAP) to capture the joint effect. This term, first used by Michael Maboussin at Credit Suisse First Boston, measures the period for which a firm can be expected to earn excess returns. The value of such a firm can then be written as the sum of the capital invested today and the present value of the

[2] Jack Welch at GE and Robert Goizueta at Coca Cola are good examples of CEOs who made a profound difference in the growth of their firms.

excess returns that the firm will earn over its life. Since there are no excess returns after the competitive advantage period, there is no additional value added.

In an inventive variant, analysts sometimes try to estimate how long the competitive advantage period will have to be to sustain a current market value, assuming that the current return on capital and cost of capital remain unchanged. The resulting market implied competitive advantage period (MICAP) can then be either compared across firms in a sector or evaluated on a qualitative basis.

II. Characteristics of Stable Growth Firm

As firms move from high growth to stable growth, you need to give them the characteristics of stable growth firms. A firm in stable growth is different from that same firm in high growth on a number of dimensions. In general, you would expect stable growth firms to be less risky, use more debt, have lower (or even no) excess returns and reinvest less than high growth firms. In this section, we will consider how best to adjust each of these variables.

a. Equity Risk

When looking at the cost of equity, high growth firms tend to be *more exposed to market risk* (and have higher betas) than stable growth firms. Part of the reason for this is that they tend to be niche players, providers of discretionary products and services and a high leverage operation. Thus, firms like Commerce One or NTT Docomo may have betas that exceed 1.5 or even 2. As these firms and their corresponding markets mature, you would expect them to have less exposure to market risk and betas that are closer to one – the average for the market. One option is to set the beta in stable growth to one for all firms, arguing that firms in stable growth should all be average risk. Another is to allow for small differences to persist even in stable growth with firms in more volatile businesses having higher betas than firms in more stable businesses. We would recommend that, as a rule of thumb, stable period betas should not exceed 1.2.[3]

But what about firms that have betas well below 1, such as commodity companies? If you are assuming that these firms will stay in their existing businesses, there is no harm in assuming that the beta remains at existing levels. However, if your estimates of growth in perpetuity[4] will require them to branch out into other business, you should adjust the beta upwards towards one.

betas.xls: This dataset on the web summarizes the average levered and unlevered betas, by industry group, for firms in the United States.

b. Project Returns

High growth firms tend to have *high returns on capital (and equity) and earn excess returns*. In stable growth, it becomes much more difficult to sustain excess returns. There are some who believe that the only assumption consistent with stable growth is to assume no excess returns; the return on capital is set equal to the cost of capital. While, in principle, excess returns in perpetuity are not feasible, it is difficult in practice to assume that firms will suddenly lose the capacity to earn excess returns. Since entire industries often earn excess returns over long periods, assuming a firm's returns on equity and capital will move towards industry averages will yield more reasonable estimates of value.

eva.xls: This dataset on the web summarizes the returns on capital (equity), costs of capital (equity) and excess returns, by industry group, for firms in the United States.

c. Debt Ratios and Costs of Debt

High growth firms tend to *use less debt* than stable growth firms. As firms mature, their debt capacity increases. When valuing firms, this will change the debt ratio that we use to compute the cost of capital. When valuing equity, changing the debt ratio will change both the cost of equity and the expected cash flows. The question whether the debt ratio for a firm should be moved towards a more sustainable level in stable growth cannot be answered without looking at the incumbent managers' views on debt and how

[3] Two thirds of U.S. firms have betas that fall between 0.8 and 1.2. That becomes the range for stable period betas.

much power stockholders have in these firms. If managers are willing to change their debt ratios and stockholders retain some power, it is reasonable to assume that the debt ratio will move to a higher level in stable growth; if not, it is safer to leave the debt ratio at existing levels.

As earnings and cash flows increase, the perceived default risk in the firm will also change. A firm that is currently losing $10 million on revenues of $100 million may be rated B, but its rating should be much better if your forecasts of $10 billion in revenues and $1 billion in operating income come to fruition. In fact, internal consistency requires that you re-estimate the rating and the cost of debt for a firm as you change its revenues and operating income.

On the practical question of what debt ratio and cost of debt to use in stable growth, you should look at the financial leverage of larger and more mature firms in the industry. One solution is to use the industry average debt ratio and cost of debt as the debt ratio and cost of debt for the firm in stable growth.

wacc.xls: This dataset on the web summarizes the debt ratios and costs of debt, by industry group, for firms in the United States.

d. Reinvestment and Retention Ratios

Stable growth firms tend to reinvest less than high growth firms and it is critical that we both capture the effects of lower growth on reinvestment and that we ensure that the firm reinvests enough to sustain its stable growth rate in the terminal phase. The actual adjustment will vary depending upon whether we are discounting dividends, free cash flows to equity or free cash flows to the firm.

In the dividend discount model, note that the expected growth rate in earnings per share can be written as a function of the retention ratio and the return on equity.

Expected Growth Rate = Retention ratio * Return on Equity

Algebraic manipulation can allow us to state the retention ratio as a function of the expected growth rate and return on equity:

[4] If you are valuing a commodity company and assuming any growth rate that exceeds inflation, you are

$$\text{Retention ratio} = \frac{\text{Expected Growth rate}}{\text{Return on Equity}}$$

If we assume, for instance, a stable growth rate of 5% (based upon the growth rate of the economy) for Procter & Gamble and a return on equity of 15% (based upon industry averages), we would be able to compute the retention ratio in stable growth:

$$\text{Retention ratio} = \frac{5\%}{15\%} = 33.33\%$$

Procter & Gamble will have to reinvest 33.33% of its earnings into the firm to generate its expected growth of 5%; it can pay out the remaining 66.67%.

In a free cash flow to equity model, where we are focusing on net income growth, the expected growth rate is a function of the equity reinvestment rate and the return on equity.

Expected Growth Rate = Equity Reinvestment rate * Return on Equity

The equity reinvestment rate can then be computed as follows:

$$\text{Equity Reinvestment rate} = \frac{\text{Expected Growth rate}}{\text{Return on Equity}}$$

If, for instance, we assume that Coca Cola will have a stable growth rate of 5.5% and that its return on equity in stable growth of 18%, we can estimate an equity reinvestment rate:

$$\text{Equity Reinvestment rate} = \frac{5.5\%}{18\%} = 30.56\%$$

Finally, looking at free cash flows to the firm, we estimated the expected growth in operating income as a function of the return on capital and the reinvestment rate:

Expected Growth rate = Reinvestment rate * Return on Capital

Again, algebraic manipulation yields the following measure of the reinvestment rate in stable growth.

$$\text{Reinvestment Rate in stable growth} = \frac{\text{Stable growth rate}}{\text{ROC}_n}$$

where the ROC_n is the return on capital that the firm can sustain in stable growth. This reinvestment rate can then be used to generate the free cash flow to the firm in the first year of stable growth.

---

assuming that your firm will branch into other businesses and you have to adjust the beta accordingly.

Linking the reinvestment rate and retention ratio to the stable growth rate also makes the valuation less sensitive to assumptions about stable growth. While increasing the stable growth rate, holding all else constant, can dramatically increase value, changing the reinvestment rate as the growth rate changes will create an offsetting effect. The gains from increasing the growth rate will be partially or completely offset by the loss in cash flows because of the higher reinvestment rate. Whether value increases or decreases as the stable growth increases will entirely depend upon what you assume about excess returns. If the return on capital is higher than the cost of capital in the stable growth period, increasing the stable growth rate will increase value. If the return on capital is equal to the stable growth rate, increasing the stable growth rate will have no effect on value. This can be proved quite easily.

$$\text{Terminal Value} = \frac{\text{EBIT}_{n+1}(1-t)(1 - \text{Reinvestment Rate})}{\text{Cost of Capital}_n - \text{Stable Growth Rate}}$$

Substituting in the stable growth rate as a function of the reinvestment rate, from above, you get:

$$\text{Terminal Value} = \frac{\text{EBIT}_{n+1}(1-t)(1 - \text{Reinvestment Rate})}{\text{Cost of Capital}_n - (\text{Reinvestment Rate} * \text{Return on Capital})}$$

Setting the return on capital equal to the cost of capital, you arrive at:

$$\text{Terminal Value} = \frac{\text{EBIT}_{n+1}(1-t)(1 - \text{Reinvestment Rate})}{\text{Cost of Capital}_n - (\text{Reinvestment Rate} * \text{Cost on Capital})}$$

Simplifying, the terminal value can be stated as:

$$\text{Terminal Value}_{\text{ROC}=\text{WACC}} = \frac{\text{EBIT}_{n+1}(1-t)}{\text{Cost of Capital}_n}$$

You could establish the same proposition with equity income and cash flows and show that a return on equity equal to the cost of equity in stable growth nullifies the positive effect of growth.

*divfund.xls*: This dataset on the web summarizes retention ratios, by industry group, for firms in the United States.

*capex.xls*: This dataset on the web summarizes the reinvestment rates, by industry group, for firms in the United States.

Illustration 12.2: Stable Growth rates and Excess Returns

Alloy Mills is a textile firm that is currently reporting after-tax operating income of $100 million. The firm has a return on capital currently of 20% and reinvests 50% of its earnings back into the firm, giving it an expected growth rate of 10% for the next 5 years:

Expected Growth rate = 20% * 50% = 10%

After year 5, the growth rate is expected to drop to 5% and the return on capital is expected to stay at 20%. The terminal value can be estimated as follows:

Expected operating income in year 6 = $100\ (1.10)^5(1.05)$ = $169.10 million

$$\text{Expected reinvestment rate from year 5} = \frac{g}{ROC} = \frac{5\%}{20\%} = 25\%$$

$$\text{Terminal value in year 5} = \frac{\$169.10(1 - 0.25)}{0.10 - 0.05} = \$2{,}537 \text{ million}$$

The value of the firm today would then be:

Value of firm today =

$$\frac{\$55}{1.10} + \frac{\$60.5}{1.10^2} + \frac{\$66.55}{1.10^3} + \frac{\$73.21}{1.10^4} + \frac{\$80.53}{1.10^5} + \frac{\$2{,}537}{1.10^5} = \$1{,}825 \text{ million}$$

If we did change the return on capital in stable growth to 10% while keeping the growth rate at 5%, the effect on value would be dramatic:

Expected operating income in year 6 = $100\ (1.10)^5(1.05)$ = $169.10 million

$$\text{Expected reinvestment rate from year 5} = \frac{g}{ROC} = \frac{5\%}{10\%} = 50\%$$

$$\text{Terminal value in year 5} = \frac{\$169.10(1 - 0.5)}{0.10 - 0.05} = \$1{,}691 \text{ million}$$

Value of firm today =

$$\frac{\$55}{1.10} + \frac{\$60.5}{1.10^2} + \frac{\$66.55}{1.10^3} + \frac{\$73.21}{1.10^4} + \frac{\$80.53}{1.10^5} + \frac{\$1{,}691}{1.10^5} = \$1{,}300 \text{ million}$$

Now consider the effect of lowering the growth rate to 4% while keeping the return on capital at 10% in stable growth:

Expected operating income in year 6 = 100 $(1.10)^5(1.04)$ = \$167.49 million

Expected reinvestment rate in year 6 = $\frac{g}{ROC} = \frac{4\%}{10\%} = 40\%$

Terminal value in year 5 = $\frac{\$169.10(1 - 0.4)}{0.10 - 0.04} = \$1{,}675 \text{ million}$

Value of firm today =

$$\frac{\$55}{1.10} + \frac{\$60.5}{1.10^2} + \frac{\$66.55}{1.10^3} + \frac{\$73.21}{1.10^4} + \frac{\$96.63}{1.10^5} + \frac{\$1{,}675}{1.10^5} = \$1{,}300 \text{ million}$$

Note that the terminal value decreases by \$16 million but the cash flow in year 5 also increases by \$16 million because the reinvestment rate at the end of year 5 drops to 40%. The value of the firm remains unchanged at \$1,600 million. In fact, changing the stable growth rate to 0% has no effect on value:

Expected operating income in year 6 = 100 $(1.10)^5$ = \$161.05 million

Expected reinvestment rate in year 6 = $\frac{g}{ROC} = \frac{0\%}{10\%} = 0\%$

Terminal value in year 5 = $\frac{\$161.05(1 - 0.00)}{0.10 - 0.00} = \$1{,}610.5 \text{ million}$

Value of firm today =

$$\frac{\$55}{1.10} + \frac{\$60.5}{1.10^2} + \frac{\$66.55}{1.10^3} + \frac{\$73.21}{1.10^4} + \frac{\$161.05}{1.10^5} + \frac{\$1{,}610.5}{1.10^5} = \$1{,}300 \text{ million}$$

Illustration 12.3: Stable Growth Inputs

To illustrate how the inputs to valuation change as we go from high growth to stable growth, we will consider three firms – Procter & Gamble, with the dividend discount model, Coca Cola with a free cashflow to equity model and Amgen.

Consider Procter & Gamble first in the context of the dividend discount model. While we will do the valuation in the next chapter, note that there are only three real inputs to the dividend discount model – the payout ratio (which determines dividends), the expected return on equity (which determines the expected growth rate) and the beta (which affects the cost of equity). In Illustration 12.1, we argued that Procter & Gamble would have a five-year high growth period. Table 12.1 summarizes the inputs into the dividend discount model for the valuation of Procter and Gamble.

Table 12.1: Inputs to Dividend Discount Model – Procter & Gamble

	High Growth Period	*Stable Growth Period*
Payout ratio	45.67%	66.67%
Return on Equity	25.00%	15.00%
Expected Growth rate	13.58%	5.00%
Beta	0.85	1.00

Note that the payout ratio and the beta for the high growth period are based upon the current year's values. The return on equity for the next 5 years is set at 25% which is below the current return on equity, but reflects the pressures that Procter & Gamble has been under recently. The expected growth rate of 13.58% for the next 5 years is the product of the return on equity and retention ratio. In stable growth, we adjust the beta to one, though the adjustment has little effect on value since the beta is already close to one. We assume that the stable growth rate will be 5%, just slightly below the nominal growth rate in the global economy. We also assume that the return on equity will drop to 15%, about halfway between the cost of equity and the average return on equity earned by brand name companies similar to Procter & Gamble today. This reflects our assumption that returns on equity will decline for the entire industry as competition from generics eats into profit margins. The retention ratio decreases to 33.33%, as both growth and ROE drop.

To analyze Coca Cola in a free cash flow to equity model, we summarize our inputs for high growth and stable growth in Table 12.2.

Table 12.2: Inputs to Free Cash flow to Equity Model – Coca Cola

	High Growth	*Stable Growth*
Return on Equity	27.83%	20.00%
Equity Reinvestment rate	39.32%	27.50%

Expected Growth	10.94%	5.50%
Beta	0.8	0.80

In high growth, the high equity reinvestment rate and high return on equity combine to generate an expected growth rate of 10.94% a year. In stable growth, we reduce the return on equity for Coca Cola to the industry average for beverage companies and estimate the expected equity reinvestment rate based upon a stable growth rate of 5.5%. The beta for the firm is left unchanged at its existing level, since Coca Cola's management has been fairly disciplined in staying focused on their core businesses.

Finally, let us consider Amgen. In Table 12.3, we report on the return on capital, reinvestment rate and expected growth for the firm in high growth and stable growth periods.

Table 12.3: Inputs to Free Cash Flow to Firm Valuation: Amgen

	High Growth	*Stable Growth*
Return on Capital	23.24%	20.00%
Reinvestment rate	56.27%	25.00%
Expected Growth	13.08%	5.00%
Beta	1.35	1.00

The firm has a high return on capital currently and we assume that this return will decrease slightly in stable growth to 20%, as the firm becomes larger and patents expire. Since the stable growth rate drops to 5%, the resulting reinvestment rate at Amgen will decrease to 25%. We will also assume that the beta for Amgen will converge on the market average.

For all of the firms, it is worth noting that you are assuming that excess returns continue in perpetuity by setting the return on capital above the cost of capital. While this is potentially troublesome, the competitive advantages that these firms have built up historically or will build up over the high growth phase will not disappear in an instant. The excess returns will fade over time, but moving them to or towards industry averages in stable growth seems like a reasonable compromise.

III. The Transition to Stable Growth

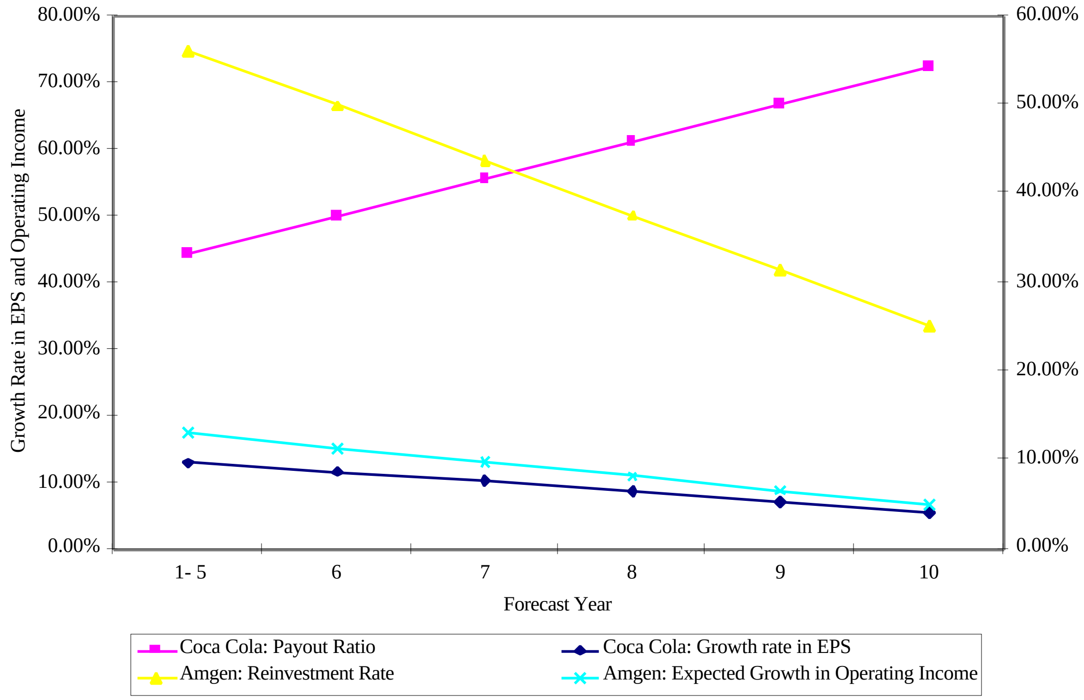
Once you have decided that a firm will be in stable growth at a point in time in the future, you have to consider how the firm will change as it approaches stable growth. There are three distinct scenarios. In the first, the firm will be maintain its high growth rate for a period of time and then become a stable growth firm abruptly; this is a two-stage model. In the second, the firm will maintain its high growth rate for a period and then have a transition period where its characteristics change gradually towards stable growth levels; this is a three stage model. In the third, the firm's characteristics change each year from the initial period to the stable growth period; this can be considered an n-stage model.

Which of these three scenarios gets chosen depends upon the firm being valued. Since the firm goes in one year from high growth to stable growth in the two-stage model, this model is more appropriate for firms with moderate growth rates, where the shift will not be too dramatic. For firms with very high growth rates in operating income, a transition phase (in a 2 stage model) allows for a gradual adjustment not just of growth rates but also of risk characteristics, returns on capital and reinvestment rates towards stable growth levels. For very young firms or for firms with negative operating margins, allowing for changes in each year (in an n-stage model) is prudent.

Illustration 12.4: Choosing a Growth Pattern

Consider the three firms analyzed in Illustration 12.3. We assumed a growth rate of 13.58% and a high growth period of 5 years for P&G, a growth rate of 10.94% and a high growth period of 10 years for Coca Cola and a growth rate of 13.08% and a high growth period of 10 years for Amgen. For Procter & Gamble, stepping down to stable growth at the end of 5 years is not likely to be as abrupt a change as it is for the other two firms and we will use a two-stage model – growth of 13.58% for 5 years and 5% thereafter. For both Coca Cola and Amgen, we will allow for a transition phase between years 6 and 10 where the inputs will change gradually from high growth to stable growth levels. Figure 12.1 reports on how the payout ratio and expected growth change at Coca Cola, from years 6 through 10, as well as the change in the return on capital and growth in operating income at Amgen over the same period.

Figure 12.1: Fundamentals and Growth in Transition



High Growth Periods without a high growth rate or a negative growth rate

Can you have high growth periods for firms that have expected growth rates that are less than or equal to the growth rate of the economy? The answer is yes, for some firms. This is because stable growth requires not just that the growth rate be less than the growth rate of the economy, but that the other inputs into the valuation are also appropriate for a stable growth firm. Consider, for instance, a firm whose operating income is growing at 4% a year but whose current return on capital is 20% and whose beta is 1.5. You would still need a transition period where the return on capital declined to more sustainable levels (say 12%) and the beta moved towards one.

By the same token, you can have an extraordinary growth period, where the growth rate is less than the stable growth rate and then moves up to the stable growth rate. For instance, you could have a firm that is expected to see its earnings grow at 2% a year for the next 5 years (which would be the extraordinary growth period) and 5% thereafter.

The Survival Issue

Implicit in the use of a terminal value in discounted cash flow valuation is the assumption that the value of a firm comes from it being a going concern with a perpetual life. For many risky firms, there is the very real possibility that they might not be in existence in 5 or 10 years, with volatile earnings and shifting technology. Should the valuation reflect this chance of failure and, if so, how can the likelihood that a firm will not survive be built into a valuation?

Life Cycle and Firm Survival

There is a link between where a firm is in the life cycle and survival. Young firms with negative earnings and cash flows can run into serious cash flow problems and end up being acquired by firms with more resources at bargain basement prices. Why are new technology firms more exposed to this problem? The negative cash flows from operations, when combined with significant reinvestment needs, can result in rapid depletion of cash reserves. When financial markets are accessible and additional equity can be raised at will; raising more funds to meet these funding needs is not a problem. However, when stock prices drop and access to markets becomes more limited, these firms can be in trouble.

A widely used measure of the potential for a cash flow problem for firms with negative earnings is the cash-burn ratio, which is estimated as the cash balance of the firm divided by its earnings before interest, taxes and depreciation (EBITDA).

$$\text{Cash Burn Ratio} = \left|\frac{\text{Cash Balance}}{\text{EBITDA}}\right|$$

Thus, a firm with a cash balance of \$ 1 billion and EBITDA of -\$1.5 billion will burn through its cash balance in 8 months.

Likelihood of Failure and Valuation

` One view of survival is that the expected cash flows that you use in a valuation reflect cash flows under a wide range of scenarios from very good to abysmal and the probabilities of the scenarios occurring. Thus, the expected value already has built into it the likelihood that the firm will not survive. Any market risk associated with survival or failure is assumed to be incorporated into the cost of capital. Firms with a high likelihood of failure will therefore have higher discount rates and lower present values.

Another view of survival is that discounted cash flow valuations tend to have an optimistic bias and that the likelihood that the firm will not survive is not considered adequately in the value. With this view, the discounted cash flow value that emerges from the analysis in the prior section overstates the value of operating assets and has to be adjusted to reflect the likelihood that the firm will not survive to deliver its terminal value or even the positive cash flows that you have forecast in future years.

Should you or should you not discount value for survival?

For firms like Cisco and Motorola that have substantial assets in place and relatively small probabilities of distress, the first view is the more appropriate one. Attaching an extra discount for non-survival is double counting risk.

For firms like Ariba and Rediff.com, it is a tougher call and depends upon whether expected cash flows consider the probability that these firms may not make it past the first few years. If they do, the valuation already reflects the likelihood that the firms will survive past the first few years. If they do not, you do have to discount the value for the likelihood that the firm will not survive the near future. One way to estimate this discount is to use the cash burn ratio, described earlier, to estimate a probability of failure and adjust the operating asset value for this probability.

Adjusted Value = DCF Value of Operating Assets (1 – Probability of distress)
+ Distressed Sale Value (Probability of distress)

For a firm with a discounted cash flow value of $1 billion on its assets, a distress sale value of $500 million and a 20% probability of default, the adjusted value would be $900 million.

Adjusted Value = $1,000 (0.8) + $500 (0.2) = $900 million

There are two points worth noting here. The first is that it is not the failure to survive per se that causes the loss of value but the fact that the distressed sale value is at a discount of the true value. The second is that this approach revolves around estimating the probability of failure. This probability is difficult to estimate because it will depend upon both the magnitude of the cash reserves of the firm (relative to its cash needs) and the state of the market. In buoyant equity markets, even firms with little or no cash can survive because they can access markets for more funds. Under more negative market conditions, even firms with significant cash balances may find themselves under threat.

There will be no discount for failure for any of the firms being valued for two reasons. One is that you are using expected cash flows that adequately reflect the likelihood of failure. The other is that each of these firms has a valuable enough niche in the market that even in the event of failure there will be other firms interested in buying their assets at a distressed sale value.

Estimating the Probability of Distress

There are two ways in which we can estimate the probability that a firm will not survive. One is to draw on the past, look at firms that have failed, compare them to firms that survived and look for variables that seem to set them apart. For instance, firms with high debt ratios and negative cash flows from operations may be more likely to fail than firms without these characteristics. In fact, you can use statistical techniques such as probits to estimate the probability that a firm will fail. To run a probit, you would begin, for instance, with all listed firms in 1990 and their financial characteristics. Identify the firms that failed during the 1991-99 time period and then estimate the probability of failure as a function of variables that were observable in 1990. The output, which resembles regression output, will then let you estimate the probability of default for any firm today.

The other way of estimating the probability of default is to use the bond rating for the firm, if it is available. For instance, assume that Commerce One has a B rating. An empirical examination of B rated bonds over the last few decades reveals that the likelihood of default with this rating is 25%.[5] While this approach is simpler, it is limiting insofar as it can be used only for rated firms and it assumes that the standards used by ratings agencies have not changed significantly over time.

Closing Thoughts on Terminal Value

[5] Professor Altman at NYU estimates these probabilities as part of an annual series that he updates. The latest version is available from the Stern School of Business Working paper series.

The role played by the terminal value in discounted cash flow valuations has often been the source of much of the criticism of the discounted cash flow approach. Critics of the approach argue that too great a proportion of the discounted cash flow value comes from the terminal value and that it is easy to manipulate the terminal value to yield any number you want. They are wrong on both counts.

It is true that a large portion of the value of any stock or equity in a business comes from the terminal value, but it would be surprising if were not so. When you buy a stock or invest in the equity in a business, consider how you get your returns. Assuming that your investment is a good investment, the bulk of the returns come not while you hold the equity (from dividends or other cash flows) but when you sell it (from price appreciation). The terminal value is designed to capture the latter. Consequently, the greater the growth potential in a business, the higher the proportion of the value that comes from the terminal value will be.

Is it easy to manipulate the terminal value? We concede that terminal value is manipulated often and easily, but it is because analysts either use multiples or because they violate one or both of two basic propositions in stable growth models. One is that the growth rate cannot exceed the growth rate of the economy. The other is that firms have to reinvest in stable growth to generate the growth rate. In fact, as we showed earlier in the chapter, it is not the stable growth rate that drives value as much as what we assume about excess returns in perpetuity. When excess returns are zero, changes in the stable growth rate have no impact on value.

Summary

The value of a firm is the present value of its expected cash flows over its life. Since firms have infinite lives, you apply closure to a valuation by estimating cash flows for a period and then estimating a value for the firm at the end of the period – a terminal value. Many analysts estimate the terminal value using a multiple of earnings or revenues in the final estimation year. If you assume that firms have infinite lives, an approach which is more consistent with discounted cashflow valuation is to assume that the cash flows of the firm will grow at a constant rate forever beyond a point in time. When the firm that you are valuing will approach this growth rate, labeled stable growth rate, is a key part of any discounted cash flow valuation. Small firms that are growing fast and have significant competitive advantages should be able to grow at high rates for much longer periods than larger and more mature firms without these competitive advantages. If you do not want to assume an infinite life for a firm, you can estimate a liquidation value based upon what others will pay for the assets that the firm has accumulated during the high growth phase.

Once the terminal values and operating cash flows have been estimated, they are discounted back to the present to yield the value of the operating assets of the firm. To this value, you add the value of cash, near-cash investments and marketable securities as well as the value of holdings in other firm to arrive at the value of the firm. Subtracting out the value of non-equity claims yields the value of equity in the firm.