

Chapter 18: Financial modeling

Long-term financial planning

Long-term financial planning and modeling can help the financial manager to reach its goal; maximizing the value of the stockholders' stake in the firm.

Making a financial model to forecast the financial statements and free cash flows of a firm allows the financial manager to identify important linkages between , for instance, sales, costs and financing. It also reveals when the firm will need additional external financing and thus there will need to be to plan for future funding needs. It also allows us to analyze the impact of potential business plans, like a big expansion.

The percent of sales method

The percent of sales method is a forecasting method that assumes that as sales grow, many income statement items and balance sheet items (costs, working capital and total assets) will also grow, remaining the same percent of sales. This method is a common starting point for forecasting.

Using this method, some items on the income statement and balance sheet are marked "NM", this means "not meaningful" in the percent of sales column. For example, the long-term debt and equity of a firm will not naturally grow in line with sales (in contrast to for example assets and accounts payable). Instead, the change in equity and debt will reflect choices we make about dividends and net new financing.

A pro forma income statement projects the firm's earnings under a given set of hypothetical assumptions. The net income, forecasted on the income statement, will be one of the inputs to the pro forma balance sheet. The part of that net income not distributed as dividends will add to stockholders' equity on the balance sheet.

A pro forma balance sheet projects the firm's assets, liabilities and equity under the same assumptions used to construct the pro forma income statement. The assets and liabilities+equity sides must be equal in a balance sheet. If the assets are projected to be more than the liabilities and equity the firm will need net new financing.

Net new financing is the amount of additional external financing a firm needs to secure to pay for the planned increase in assets. $\text{Net new financing} = \text{Projected assets} - \text{Projected liabilities and equity}$

Forecasting the balance sheet with the percent of sales method requires two passes:

1. The first pass reveals by how much equity and liabilities would fall short of the amount needed to finance the expected growth in assets. This amount by which the financing falls short is called the plug: the amount of net new financing that needs to be added to the liabilities and equity side of the pro forma balance sheet to make it balance.
2. In the second pass, the pro forma balance sheet shows the necessary financing from the planned sources and is in balance.

A planned expansion

The percent of sales method may even be sufficient for mature companies with relatively stable but slow growth. However, its shortcoming is handling fast growth requiring lumpy investments in new capacity.

An improvement relative to the percent of sales method is to forecast the firm's working capital and capital investment, along with planned financing of those investments directly. With such a model, we can estimate the firm's future free cash flows, because the model will have the correct timing of external financing and capital investment.

A firm will have to seek for external financing for the debt it has. This can for example be done by issuing coupon bonds. The firm will only pay interest on the bonds until the repayment of principal.

Interest in year t = Interest rate \times Ending balance in year $(t-1)$

To build the pro forma income statement we need to calculate the sales:

Sales = Market size \times Market share \times Average sales price

- If liabilities and equity together are less than assets: new financing is needed, the firm must borrow or issue new equity to fund the shortfall.
- If liabilities and equity together are greater than assets: excess cash is available, the firm can retain it as excess cash reserves (thus increasing assets), pay dividends or reduce external financing by retiring debt or repurchasing shares.

Growth and firm value

Growth (expansion) may add to or detracts from the value of the firm. We now will discuss two growth rates that factor in financing needs and revisit our top decision rule: NPV analysis.

The internal growth rate is the maximum growth rate a firm can achieve without resorting to external financing. In other words, this is the growth a firm can support by reinvesting its earnings.

$$\text{Internal growth rate} = \left(\frac{\text{Net Income}}{\text{Beginning assets}} \right) \times (1 - \text{Payout ratio})$$

$$\text{Internal growth rate} = \text{ROA} \times \text{Retention rate}$$

In this context, the retention rate is often called the plowback ratio: one minus the payout ratio of the firm.

The sustainable growth rate is the maximum growth rate a firm can achieve without issuing new equity or increasing its debt-to-equity ratio. In other words, this growth rate tells how fast the firm can grow by reinvesting its retained earnings and issuing only as much new debt as can be supported by those retained earnings.

$$\text{Sustainable growth rate} = \left(\frac{\text{Net Income}}{\text{Beginning Equity}} \right) \times (1 - \text{payout ratio})$$

$$\text{Sustainable growth rate} = \text{ROE} \times \text{Retention rate}$$

The sustainable growth rate will be greater than the internal growth rate, because the ROE will be larger than the ROA anytime you have debt.

Imagine your forecasted growth is greater than the internal growth rate, in this case you will have to either reduce your payout ratio (increase your plowback ratio), plan to raise additional external financing, or both.

Imagine you forecasted growth is greater than the sustainable growth rate, in this case you will have to increase your plowback ratio, raise additional equity financing, or increase your leverage (increase your debt faster than keeping you debt-to-equity ratio constant would allow).

	Internal Growth Rate	Sustainable Growth Rate
Formula:	ROA x Retention Rate	ROE x Retention Rate
Maximum growth financed only by:	Retained earnings	Retained earnings and new debt that keeps the D/E ratio constant
To grow faster, a firm must:	Reduce payout or raise external capital	Reduce payout, or raise new equity, or increase leverage.

The internal growth rate and the sustainable growth rate cannot tell you whether your planned growth increases or decreases the value of the firm. This growth rates are only useful in alerting you to the need to plan for external financing.

The growth rate does not evaluate the future costs and benefits of the growth. According to the Valuation Principle, growth rates must do so to make value implications. Only an NPV analysis can tell us whether the contemplated growth will increase or decrease the value of the firm.

Valuing the planned expansion

The Valuation Principle helps us to determine whether the expansion is a good idea, after we have the implications of the planned expansion for the debt, net income and working capital.

To estimate the free cash flows, we combine the earnings, depreciation and interest expenses (income statement), the capital expenditures and the changes in net working capital. The forecasted free cash flow is the net income, plus the after-tax interest expense. This is called the unlevered net income.

$$\text{After-tax interest expense} = (1 - \text{tax rate}) \times (\text{interest earned on debt} - \text{interest paid on excess cash})$$

To the unlevered net income, we add the depreciation and we subtract the increases in NWC and the capital expenditures to get the free cash flow of the firm. This free cash flow is the cash the firm will generate for its investors, both debt and equity holders.

To calculate the free cash flow to equity holders, we can adjust the free cash flows to account for all (after-tax) payments to or from debt holders. So, from the free cash flow we subtract the after-tax interest expense and we add the increase in debt to calculate the free cash flows to equity. This cash flow is the total amount of excess cash flows that belongs to the equity holder for them to use to pay dividends, repurchase shares and retain in the firm as cash, or retire debt.

In addition to forecasting cash flows for a few years, we need to estimate the firm's continuation value at the end of the forecast horizon. Because distant cash flows are difficult to forecast accurately, estimating the continuation value of a firm based on a long-term estimate of the valuation multiple for the industry is a common approach.

The EBITDA (earnings before interest, taxes, depreciation and amortization) is the most often used valuation multiple. Because the EBITDA accounts for the firm's operating efficiency and because it is not affected by leverage differences between firms, the multiple is more reliable than sales or earnings multiples.

Continuation enterprise value at forecast horizon = EBITDA at horizon \times EBITDA multiple at horizon.

When calculating the firm's value with an expansion you have to do the following steps:

1. First need to calculate the present value of the free cash flows. You have to discount the free cash flows at the firm's pretax WACC because they represent cash flows to both debt and equity holders and because you have to account for the benefits of the interest tax shield separately.
2. Second step is to calculate the present value of the continuation value. The discount rate is the same as before.
3. Finally, because the expansion is financed with debt, you will have additional interest tax shields. The interest tax shield is calculated by multiplying the net interest expense by the tax rate. To calculate the present value of the interest tax shield you have to use the interest rate on debt as the discount rate. You do not use the WACC, because the tax shield is only as risky as the debt that creates it.

The total firm value is the sum of the present values of the forecasted unlevered free cash flows (step 1), the continuation value of the firm (step 2) and the interest tax shields (step 3).

If you want to know if the expansion is a good idea, you can compare the firm's value with the expansion to the firm's value without the expansion.

But what if the firm has the option to simply delay its expansion for one or more years? To analyze this, you need to repeat the valuation analysis above for expansion in each following year. The value of a firm may be maximized by delaying the expansion. The reason is that while delaying expansion means the firm cannot produce enough units to meet the demand, the shortfall is not too great until a certain year.