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METHODS OF VALUATION FOR MERGERS AND ACQUISITIONS

This note addresses the methods used to value companies in a merger and acquisitions (M&A) setting. It provides a detailed description of the discounted-cash-flow (DCF) approach and reviews other methods of valuation, such as market multiples of peer firms, book value, liquidation value, replacement cost, market value, and comparable transaction multiples.

Discounted-Cash-Flow Method

Overview

The DCF approach in an M&A setting attempts to determine the *enterprise value* or value of the company, by computing the present value of cash flows over the life of the company.[1] Because a corporation is assumed to have infinite life, the analysis is broken into two parts: a forecast period and a terminal value. In the *forecast period*, explicit forecasts of free cash flow that incorporate the economic costs and benefits of the transaction must be developed. Ideally, the forecast period should comprise the interval over which the firm is in a transitional state, as when enjoying a temporary competitive advantage (i.e., the circumstances where expected returns exceed required returns). In most circumstances, a forecast period of five or ten years is used.

The *terminal value* of the company, derived from free cash flows occurring after the forecast period, is estimated in the last year of the forecast period and capitalizes the present value of all future cash flows beyond the forecast period. To estimate the terminal value, cash flows are projected under a steady-state assumption that the firm enjoys no opportunities for abnormal growth or that expected returns equal required returns following the forecast period. Once a schedule of free cash flows is developed for the enterprise, the weighted average cost of

[1] This note focuses on valuing the company as a whole (i.e., the enterprise). An estimate of equity value can be derived under this approach by subtracting interest-bearing debt from enterprise value. An alternative method not pursued here values the equity using residual cash flows, which are computed as net of interest payments and debt repayments plus debt issuances. Residual cash flows must be discounted at the cost of equity.

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capital (WACC) is used to discount them to determine the present value. The sum of the present values of the forecast period and the terminal value cash flows provides an estimate of company or enterprise value.

Review of DCF basics

Let us briefly review the construction of free cash flows, terminal value, and the WACC. It is important to realize that these fundamental concepts work equally well when valuing an investment project as they do in an M&A setting.

Free cash flows: The free cash flows in an M&A analysis should be the expected incremental operating cash flows attributable to the acquisition, before consideration of financing charges (i.e., prefinancing cash flows). Free cash flow equals the sum of net operating profits after taxes (NOPAT), plus depreciation and noncash charges, less capital investment and less investment in working capital. NOPAT captures the earnings after taxes that are available to all providers of capital. That is, NOPAT has no deductions for financing costs. Moreover, because the tax deductibility of interest payments is accounted for in the WACC, such financing tax effects are also excluded from the free cash flow, which is expressed in **Equation 1**:

$$FCF = NOPAT + Depreciation - CAPEX - \Delta NWC \tag{1}$$

where:

- *NOPAT* is equal to *EBIT (1 – t)* where *t* is the appropriate marginal (not average) cash tax rate, which should be inclusive of federal, state, local, and foreign jurisdictional taxes.
- *Depreciation* is noncash operating charges including depreciation, depletion, and amortization recognized for tax purposes.
- *CAPEX* is capital expenditures for fixed assets.
- ΔNWC is the increase in net working capital defined as current assets less the non-interest-bearing current liabilities.[2]

The cash-flow forecast should be grounded in a thorough industry and company forecast. Care should be taken to ensure that the forecast reflects consistency with firm strategy as well as with macroeconomic and industry trends and competitive pressure.

The forecast period is normally the years during which the analyst estimates free cash flows that are consistent with creating value. A convenient way to think about value creation is

[2] The net working capital should include the expected cash, receivables, inventory, and payables levels required for the operation of the business. If the firm currently has excess cash (more than is needed to sustain operations), for example, the cash forecast should be reduced to the level of cash required for operations. Excess cash should be valued separately by adding it to the enterprise value.

whenever the return on net assets (RONA)[3] exceeds the WACC.[4] RONA can be divided into an income statement component and a balance sheet component:

$$RONA = NOPAT/Net\ Assets$$

$$= NOPAT/Sales \times Sales/Net\ Assets$$

In this context, value is created whenever earnings power increases (NOPAT/Sales) or when asset efficiency is improved (Sales/Net Assets). In other words, analysts are assuming value creation whenever they allow the profit margin to improve on the income statement and whenever they allow sales to improve relative to the level of assets on the balance sheet.

Terminal value: A terminal value in the final year of the forecast period is added to reflect the present value of all cash flows occurring thereafter. Because it capitalizes all future cash flows beyond the final year, the terminal value can be a large component of the value of a company, and therefore deserves careful attention. This can be of particular importance when cash flows over the forecast period are close to zero (or even negative) as the result of aggressive investment for growth.

A standard estimator of the terminal value (TV) in the final year of the cash-flow forecast is the constant growth valuation formula (**Equation 2**).

$$Terminal\ Value = FCF^{Steady\ State} \div (WACC - g) \qquad (2)$$

where:

- $FCF^{Steady\ State}$ is the steady-state expected free cash flow for the year after the final year of the cash-flow forecast
- $WACC$ is the weighted average cost of capital
- g is the expected steady-state growth rate of $FCF^{Steady\ State}$ in perpetuity

The free cash-flow value used in the constant growth valuation formula should reflect the steady-state cash flow for the year after the forecast period. The assumption of the formula is that in steady state, this cash flow will grow in perpetuity at the steady-state growth rate. A convenient approach is to assume that RONA remains constant in perpetuity; that is, both profit margin and asset turnover remain constant in perpetuity. Under this assumption, the analyst grows all financial statement line items (i.e., revenue, costs, assets) at the expected steady-state

[3] In this context, we define net assets as total assets less non-interest-bearing current liabilities or equivalently as net working capital plus net fixed assets. A similar relationship can be expressed using return on capital (ROC). Because the uses of capital (working capital and fixed assets) equal the sources of capital (debt and equity), it follows that RONA (return on net assets) equals ROC and therefore, ROC = NOPAT/(Debt + Equity).

[4] WACC is discussed later in this note as the appropriate discount rate used for the free cash flows.

growth rate. In perpetuity, this assumption makes logical sense in that if a firm is truly in steady state, the financial statements should be growing, by definition, at the same rate.

Discount rate: The discount rate should reflect the weighted average of investors' opportunity cost (WACC) on comparable investments. The WACC matches the business risk, expected inflation, and currency of the cash flows to be discounted. In order to avoid penalizing the investment opportunity, the WACC also must incorporate the appropriate target weights of financing going forward. Recall that the appropriate rate is a blend of the required rates of return on debt and equity, weighted by the proportion of the firm's market value they make up (**Equation 3**).

$$WACC = W_d\, k_d\,(1 - t) + W_e\, k_e \tag{3}$$

where:

- k_d is the required yield on new debt: It is yield to maturity.
- k_e is the cost of equity capital.
- W_d, W_e are target percentages of debt and equity (using market values of debt and equity).[5]
- t is the marginal tax rate.

The costs of debt and equity should be going-forward market rates of return. For debt securities, this is often the yield to maturity that would be demanded on new instruments of the same credit rating and maturity. The cost of equity can be obtained from the Capital Asset Pricing Model (CAPM) (**Equation 4**).

$$k_e = R_f + \beta\,(R_m - R_f) \tag{4}$$

where:

- R_f is the expected return on risk-free securities over a time horizon consistent with the investment horizon. Most firm valuations are best served by using a long maturity government bond yield.
- $R_m - R_f$ is the expected market risk premium. This value is commonly estimated as the average historical difference between the returns on common stocks and long-term government bonds. For example, Ibbotson Associates estimated the geometric mean return between 1926 and 2007 for large capitalization U.S. equities between 1926 and 2007 was 10.4%. The geometric mean return on long-term government bonds was 5.5%. The difference between the two implies a historical market-risk premium of about 5.0%.

[5] Debt for purposes of the WACC should include all permanent, interest-bearing debt. If the market value of debt is not available, the book value of debt is often assumed as a reasonable proxy. The shorter the maturity of the debt and the closer the correspondence between the coupon rate and required return on the debt, the more accurate the approximation.

In practice one observes estimates of the market risk premium that commonly range from 5% to 8%.

- ß or beta is a measure of the systematic risk of a firm's common stock. The beta of common stock includes compensation for business and financial risk.

The M&A Setting

No doubt, many of these concepts look familiar. Now we must consider how they are altered by the evaluation of a company in an M&A setting. First, we should recognize that there are two parties (sometimes more) in the transaction: an acquirer (buyer or bidder) and a target firm (seller or acquired). Suppose a bidder is considering the potential purchase of a target firm and we must assess whether the target would be a good investment. Some important questions arise in applying our fundamental concepts:

1. *What are the potential sources of value from the combination? Does the acquirer have particular skills or capabilities that can be used to enhance the value of the target firm? Does the target have critical technology or other strengths that can bring value to the acquirer?*

Potential sources of gain or cost savings achieved through the combination are called *synergies*. Baseline cash-flow projections for the target firm may or may not include synergies or cost savings gained from merging the operations of the target into those of the acquirer. If the base-case cash flows do not include any of the economic benefits an acquirer might bring to a target, they are referred to as *stand-alone* cash flows. Examining the value of a target on a stand-alone basis can be valuable for several reasons. First, it can provide a view of what the target firm is capable of achieving on its own. This may help establish a floor with respect to value for negotiating purposes. Second, construction of a stand-alone DCF valuation can be compared with the target's current market value. This can be useful in assessing whether the target is under- or overvalued in the marketplace. Given the general efficiency of markets, however, it is unlikely that a target will be significantly over- or undervalued relative to the market. Hence, a stand-alone DCF valuation allows analysts to calibrate model assumptions to those of investors. By testing key assumptions relative to this important benchmark, analysts can gain confidence that the model provides a reasonable guide to investors' perception of the situation.

2. *What is the proper discount rate to use?*

The discount rate used to value the cash flows of the target should compensate the investor/acquiring firm for the risk of the cash flows. Commonly, the cost of capital of the target firm provides a suitable discount rate for the stand-alone and merger cash flows. The cost of capital of the target firm is generally more appropriate as a discount rate than the cost of capital of the acquiring firm because the target cost of capital generally better captures the risk premium associated with bearing the risk of the target cash flows than does the cost of capital of the acquiring firm. If the target and acquirer are in the same industry, they likely have similar business risk. Because in principle the business risk is similar for the target and the acquirer,

either one's WACC may be justifiably used. The use of the target's cost of capital also assumes that the target firm is financed with the optimal proportions of debt and equity and that these proportions will continue after the merger.

Additional information on the appropriate discount rate can be obtained by computing the WACCs of firms in the target's industry. These estimates can be summarized by taking the average or median WACC. By using the betas and financial structures of firms engaged in this line of business, a reliable estimate of the business risk and optimal financing can be established going forward.

Sometimes an acquirer may intend to increase or decrease the debt level of the target significantly after the merger—perhaps because it believes the target's current financing mix is not optimal. The WACC still must reflect the business risk of the target. A proxy for this can be obtained from the unlevered beta of the target firm's equity or an average unlevered beta for firms with similar business risk. The target's premerger unlevered beta must then be relevered to reflect the acquirer's intended postmerger capital structure.

To unlever a firm beta, one uses the prevailing tax rate (T) and the predeal debt-to-equity ratio (D/E) of the firm associated with the beta estimate ($ß_L$) to solve **Equation 5**:

$$ß_u = ß_L / [1 + (1 - T)\, D/E] \tag{5}$$

Next, one uses the unlevered beta estimate ($ß_u$) or average unlevered beta estimate (if using multiple firms to estimate the unlevered beta) to relever the beta to the new intended debt-to-equity ratio (D/E^*) (**Equation 6**):

$$ß'_L = ß_u\, [1 + (1 - T)\, D/E^*] \tag{6}$$

The result is a relevered beta estimate ($ß'_L$) that captures the business risk and the financial risk of the target cash flows.

The circumstances of each transaction will dictate which of these approaches is most reasonable. Of course, if the target's business risk somehow changes because of the merger, some adjustments must be made to all of these approaches on a judgment basis. The key concept is to find the discount rate that best reflects the business and financial risks of the target's cash flows.

3. *After determining the enterprise value, how is the value of the equity computed?*

This is a straightforward calculation that relies upon the definition of enterprise value as the value of cash flows available to *all* providers of capital. Because debt and equity are the sources of capital, it follows that enterprise value (V) equals the sum of debt (D) and equity (E) values (**Equation 7**):

$$V = D + E \tag{7}$$

Therefore, the value of equity is simply enterprise value less the value of existing debt (**Equation 8**):

$$E = V - D \tag{8}$$

where debt is the market value of all interest-bearing debt outstanding at the time of the acquisition. For publicly traded targets, the value of the share price can be computed by simply dividing the equity value by the numbers of shares of stock outstanding.

4. How does one incorporate the value of synergies in a DCF analysis?

Operating synergies are reflected in enterprise value by altering the stand-alone cash flows to incorporate the benefits and costs of the combination. Free cash flows that include the value an acquirer and target can achieve through combination and are referred to as *combined* or *merger* cash flows.

If the acquirer plans to run the acquired company as a stand-alone entity, as in the case of Berkshire Hathaway purchasing a company unrelated to its existing holdings (e.g., Dairy Queen), there may be little difference between the stand-alone and merger cash flows. In many strategic acquisitions, however, such as the Pfizer/Wyeth and InBev/Fujian Sedrin Brewery mergers, there can be sizeable differences.

How the value of these synergies is split among the parties through the determination of the final bid price or premium paid is a major issue for negotiation.[6] If the bidder pays a premium equal to the value of the synergies, all the benefits will accrue to target shareholders, and the merger will be a zero net-present-value investment for the shareholders of the acquirer.

Example of the DCF Method

Suppose Company A has learned that Company B (a firm in a different industry but in a business that is strategically attractive to Company A) has retained an investment bank to auction the company and all of its assets. In considering how much to bid for Company B, Company A starts with the cash-flow forecast of the stand-alone business drawn up by Company B's investment bankers shown in **Table 1**. The discount rate used to value the cash flows is Company B's WACC of 10.9%. The inputs to WACC, with a market risk premium of 6%, are shown in **Table 2**.

On a stand-alone basis, the analysis in **Table 1** suggests that Company B's enterprise value is $9.4 million.

[6] The premium paid is usually measured as: (Per-Share Bid Price – Market Price for Target Shares Before Merger) ÷ Market Price for Target Shares Before Merger.

Table 1. Valuation of Company B as a stand-alone unit.
(assume that Company A will allow Company B to run as a stand-alone unit with no synergies)

Revenue growth	6.0%		Steady state growth			5.9%	
COGS	55%		WACC			10.9%	
SG&A	20%		Tax rate			39%	
Net working capital (NWC)	22%						Year 6 Steady State
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	
Revenues ($ thousands)	9,750	10,000	10,600	11,236	11,910	12,625	13,370
COGS		5,500	5,830	6,180	6,551	6,944	
Gross profit		4,500	4,770	5,056	5,360	5,681	
SG&A		2,000	2,120	2,247	2,382	2,525	
Depreciation		1,000	1,000	1,000	1,000	1,000	
EBIT		1,500	1,650	1,809	1,978	2,156	
Less taxes		(585)	(644)	(706)	(771)	(841)	
NOPAT		915	1,007	1,103	1,207	1,315	1,393
Add: depreciation		1,000	1,000	1,000	1,000	1,000	} (664)
Less: capital expenditures		(1,250)	(1,250)	(1,250)	(1,250)	(1,250)	
Less: Increase in NWC		(55)	(132)	(140)	(148)	(157)	(164)
= Free cash flow		610	625	713	809	908	565
Terminal value						11,305	
Free Cash Flows + Terminal Value		610	625	713	809	12,213	
Enterprise Value $PV_{10.9\%}$ (FCF) =	9,396						
NWC (22% Sales)	2,145	2,200	2,332	2,472	2,620	2,777	2,941
NPPE (+ CAPEX – Depr. each year)	10,000	10,250	10,500	10,750	11,000	11,250	11,914
Operating margin [NOPAT/Sales]		9.2%	9.5%	9.8%	10.1%	10.4%	10.4%
PPE turnover [Sales/NPPE]		0.98	1.01	1.05	1.08	1.12	1.12
RONA [NOPAT/(NWC+NPPE)]		7.3%	7.8%	8.3%	8.9%	9.4%	9.4%

Year 6 Steady-State Calculations:

Sales = Year 5 Sales × (1 + Steady-State Growth) = 12,625 × 1.059 = 13,370
NOPAT = Year 5 NOPAT × (1 + Steady-State Growth) = 1,315 × 1.059 = 1,393
NWC = Year 5 NWC × (1 + Steady-State Growth) = 2,777 × 1.059 = 2,941
NPPE = Year 5 NPPE × (1 + Steady-State Growth) = 11,250 × 1.059 = 11,914
Increase in NPPE = Capital Expenditures less Depreciation = 11,250 – 11,914 = –664
Year 5 Terminal Value = Steady-State FCF ÷ (WACC – Steady-State Growth) = 565 ÷ (0.109 – 0.059) = 11,305

Table 2. Inputs to WACC.

	Bidder	**Target**
	A-Co.	*B-Co.*
Bond rating	A	BBB
Yield to maturity of bonds—k_d	7.2%	7.42%
Tax rate	39.0%	39.0%
After-tax cost of debt—$k_d(1-t)$	4.39%	4.53%
Beta	1.05	1.20
Cost of equity—k_e	12.18%	13.08%
Debt as % of capital—W_d	20.0%	25.0%
Equity as % of capital—W_e	80.0%	75.0%
10-year treasury bond yield	5.88%	5.88%
Market risk premium	6.0%	6.0%
WACC	10.6%	10.9%

Now suppose Company A believes that it can make Company B's operations more efficient and improve its marketing and distribution capabilities. In **Table 3**, we incorporate these effects into the cash-flow model, thereby estimating a higher range of values that Company A can bid and still realize a positive net present value (NPV) for its shareholders. In the merger cash-flow model of the two firms in **Table 3**, Company B has added two percentage points of revenue growth, subtracted two percentage points from the COGS[7]/Sales ratio, and subtracted one percentage point from SG&A/Sales ratio relative to the stand-alone model. We assume that all of the merger synergies will be realized immediately and therefore should fall well within the five-year forecast period. The inputs to target and acquirer WACCs are summarized in **Table 3**.

Because Company A and Company B are in different industries, it is not appropriate to use Company A's WACC of 10.6% in discounting the expected cash flows. Despite the fact that after the merger, Company B will become part of Company A, we do not use Company A's WACC because it does not reflect the risk associated with the merger cash flows. In this case, one is better advised to focus on "where the money is going, rather than where the money comes from" in determining the risk associated with the transaction. In other words, the analyst should focus on the target's risk and financing (not the buyer's risk and financing) in determining the appropriate discount rate. The discount rate should reflect the expected risk of the cash flows being priced and not necessarily the source of the capital.

Notice that the value with synergies, $15.1 million, exceeds the value as a stand-alone entity by $5.7 million. In devising its bidding strategy, Company A would not want to offer the full $15.1 million and concede all the value of the synergies to Company B. At this price, the NPV of the acquisition to Company A is zero. The existence of synergies, however, allows Company A leeway to increase its bid above $9.4 million and enhance its chances of winning the auction.

[7] Cost of Goods Sold.

Table 3. Valuation of Company B with synergies.
(assume that Company B merges with Company A and realizes operational synergies)

Revenue growth	8.0%	Steady state growth	5.9%
COGS	53%	WACC	10.9%
SG&A	19%	Tax rate	39%
Net working capital (NWC)	22%		

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6 Steady State
Revenues ($ in thousands)	9,750	10,000	10,800	11,664	12,597	13,605	14,408
COGS		5,300	5,724	6,182	6,676	7,211	
Gross profit		4,700	5,076	5,482	5,921	6,394	
SG&A		1,900	2,052	2,216	2,393	2,585	
Depreciation		1,000	1,000	1,000	1,000	1,000	
EBIT		1,800	2,024	2,266	2,527	2,809	
Less taxes		(702)	(789)	(884)	(986)	(1,096)	
NOPAT		1,098	1,235	1,382	1,542	1,714	1,815
Add: depreciation		1,000	1,000	1,000	1,000	1,000	
Less: capital expenditures		(1,250)	(1,250)	(1,250)	(1,250)	(1,250)	(664)
Less: increase in NWC		(55)	(176)	(190)	(205)	(222)	(177)
= Free cash flow		793	809	942	1,086	1,242	974
Terminal value						19,490	
Free Cash Flows + Terminal Value		793	809	942	1,086	20,732	
Enterprise Value $PV_{10.9\%}$ (FCF) =	15,140						
NWC (22% sales)	2,145	2,200	2,376	2,566	2,771	2,993	3,170
NPPE (+ CAPEX – Depr. each year)	10,000	10,250	10,500	10,750	11,000	11,250	11,914
Operating margin [NOPAT/Sales]		11.0%	11.4%	11.9%	12.2%	12.6%	12.6%
PPE turnover [Sales/NPPE]		0.98	1.03	1.09	1.15	1.21	1.21
RONA [NOPAT/(NWC+NPPE)]		8.8%	9.6%	10.4%	11.2%	12.0%	12.0%

Year 6 Steady-State Calculations:

Sales = Year 5 Sales × (1 + Steady-State Growth) = 13,605 × 1.059 = 14,408
NOPAT = Year 5 NOPAT × (1 + Steady-State Growth) = 1,714 × 1.059 = 1,815
NWC = Year 5 NWC × (1 + Steady-State Growth) = 2,993 × 1.059 = 3,170
NPPE = Year 5 NPPE × (1 + Steady-State Growth) = 11,250 × 1.059 = 11,914
Increase in NPPE = Capital Expenditures less Depreciation = 11,250 – 11,914 = –664
Year 5 Terminal Value = Steady-State FCF ÷ (WACC – Steady-State Growth) = 974 ÷ (0.109 – 0.059) = 19,490

Considerations for Terminal Value Estimation

In the valuation of both the stand-alone and merger cash flows, the terminal value contributes the bulk of the total cash-flow value (if the terminal value is eliminated, the enterprise value drops by about 75%). This relationship between terminal value and enterprise value is typical of firm valuation because of the ongoing nature of the life of a business. Because of the importance of the terminal value in firm valuation, the assumptions that define the terminal value deserve particular attention.

In the stand-alone Company B valuation in **Table 1**, we estimated the terminal value using the constant-growth valuation model. This formula assumes that the business has reached some level of steady-state growth such that the free cash flows can be modeled to infinity with the simple assumption of a constant growth rate. Because of this assumption, it is important that the firm's forecast period be extended until such a steady state is truly expected.[8] The terminal-value growth rate used in the valuation is 5.9%. In this model the analyst assumes that the steady-state growth rate can be approximated by the long-term risk-free rate (i.e., the long-term Treasury bond yield). Using the risk-free rate to proxy for the steady-state growth rate is equivalent to assuming that the expected long-term cash flows of the business grow with the overall economy (i.e., nominal expected growth rate of GDP). Nominal economic growth contains a real growth component plus an inflation rate component, which are also reflected in long-term government bond yields. For example, the Treasury bond yield can be decomposed into a real rate of return (typically between 2% and 3%) and expected long-term inflation. Because the Treasury yield for our example is 5.9%, the implied inflation is between 3.9% and 2.9%. Over the long term, companies should experience the same real growth and inflationary growth as the economy on average, which justifies using the risk-free rate as a reasonable proxy for the expected long-term growth of the economy.

Another important assumption is estimating steady-state free cash flow that properly incorporates the investment required to sustain the steady-state growth expectation. The steady-state free-cash-flow estimate used in the merger valuation in **Table 3** is $974,000. To obtain the steady-state cash flow, we start by estimating sales in **Equation 9**:[9]

$$Sales^{Steady\ State} = Sales^{Year\ 5} \times (1 + g) = 13{,}605 \times 1.059 = 14{,}408 \qquad (9)$$

Steady state demands that all the financial statement items grow with sales at the same steady-state rate of 5.9%. This assumption is reasonable because in steady state, the enterprise should be growing at a constant rate. If the financial statements did not grow at the same rate, the implied

[8] The steady state may only be accurate in terms of expectations. The model recognizes that the expected terminal value has risk. Businesses may never actually achieve steady state due to technology innovations, business cycles, and changing corporate strategy. The understanding that the firm may not actually achieve a steady state does not preclude the analyst from anticipating a steady-state point as the best guess of the state of the business at some point in the future.

[9] Note that **Tables 1** and **3** summarize the steady-state calculations.

financial ratios (e.g., operating margins or RONA) would eventually widely deviate from reasonable industry norms.

The steady-state cash flow can be constructed by simply growing all relevant line items at the steady-state growth rate as summarized in **Tables 1** and **3.** To estimate free cash flow we need to estimate the steady-state values for NOPAT, net working capital, and net property, plant and equipment. By simply multiplying the Year 5 value for each line item by the steady-state growth factor of 1.059, we obtain the steady-state Year 6 values.[10] Therefore, to estimate the steady-state change in NWC we use the difference in the values for the last two years (**Equation 10**):

$$\Delta NWC^{Steady\ State} = NWC^{Year\ 5} - NWC^{Steady\ State} = 2{,}993 - 3{,}170 = -177 \qquad (10)$$

This leaves depreciation and capital expenditure as the last two components of cash flow. These can be more easily handled together by looking at the relation between sales and net property, plant, and equipment where NPPE is the accumulation of capital expenditures less depreciation. **Table 3** shows that in the steady-state year NPPE has increased to 11,914. The difference of NPPE gives us the net of capital expenditures and depreciation for the steady state (**Equation 11**):

$$\Delta NPPE^{Steady\ State} = NPPE^{1995} - NPPE^{Steady\ State} = 11{,}250 - 11{,}914 = -664 \qquad (11)$$

Summing the components gives us the steady-state free cash flow (**Equation 12**):

$$\begin{aligned} FCF^{Steady\ State} &= NOPAT^{Steady\ State} + \Delta NPPE^{Steady\ State} + \Delta NWC^{Steady\ State} \\ &= 1{,}815 \qquad -664 \qquad -176 \\ &= 974^{11} \end{aligned} \qquad (12)$$

Therefore, by maintaining steady-state growth across the firm, we have estimated the numerator of the terminal value formula that gives us the value of all future cash flows beyond Year 5 (**Equation 13**):

$$Terminal\ Value^{Year\ 5} = FCF^{Steady\ State} \div (WACC - g) = 974 \div (0.109 - 0.059) = 19{,}490 \qquad (13)$$

The expression used to estimate steady-state free cash flow can be used for alternative assumptions regarding expected growth. For example, one might also assume that the firm does not continue to build new capacity but that merger cash flows grow only with expected inflation (e.g., 3.9%). With this scenario, the calculations are similar but the growth rate is replaced with

[10] Alternatively, we can compute NOPAT using Year 5's NOPAT/Sales ratio of 12.6% or net working capital using the same 22% of sales relation used throughout the analysis. As long as the ratios are constant and linked to the steady-state sales value, the figures will capture the same-steady state assumptions.

[11] Note that we can demonstrate that the cash-flow estimation process is consistent with the steady-state growth if we were to do these same calculations, using the same growth rate for one more year, the resulting FCF would be 5.9% higher (i.e., 974 × 1.059 = 1,031).

the expected inflation. Even if capacity is not expanded, investment must keep up with growth in profits to maintain a constant expected rate of operating returns.

Finally, it is important to acknowledge that the terminal value estimate embeds assumptions about the long-term profitability of the target firm. In the example in **Table 3**, the implied steady-state RONA can be calculated by dividing the steady-state NOPAT by the steady-state net assets (NWC + NPPE). In this case, the return on net assets is equal to 12.0% [1,815 ÷ (3,170 + 11,914)]. Because in steady state the profits and the assets will grow at the same rate, this ratio is estimated to remain in perpetuity. The discount rate of 10.9% maintains a benchmark for the steady-state RONA. Because of the threat of competitive pressure, it is difficult to justify in most cases a firm valuation where the steady-state RONA is substantially higher than the WACC. Alternatively, if the steady-state RONA is lower than the WACC, one should question the justification for maintaining the business in steady state if the assets are not earning the cost of capital.

Market Multiples as Alternative Estimators of Terminal Value

Given the importance attached to terminal value, analysts are wise to use several approaches when estimating it. A common approach is to estimate terminal value using market multiples derived from information based on publicly traded companies similar to the target company (in our example, Company B). The logic behind a market multiple is to see how the market is currently valuing an entity based on certain benchmarks related to value rather than attempting to determine an entity's inherent value. The benchmark used as the basis of valuation should be something that is commonly valued by the market and highly correlated with market value. For example, in the real estate market, dwellings are frequently priced based on the prevailing price per square foot of comparable properties. The assumption made is that the size of the house is correlated with its market value. If comparable houses are selling at $100 per square foot, the market value for a 2,000-square-foot house is estimated to be worth $200,000. For firm valuation, current or expected profits are frequently used as the basis for relative market multiple approaches.

Suppose, as shown in **Table 4**, that there are three publicly traded businesses that are in the same industry as Company B: Company C, Company D, and Company E. The respective financial and market data that apply to these companies are shown in **Table 4**. The enterprise value for each comparable firm is estimated as the current share price multiplied by the number of shares outstanding (equity value) plus the book value of debt. Taking a ratio of the enterprise value divided by the operating profit (EBIT), we obtain an EBIT multiple. In the case of Company C, the EBIT multiple is 5.3 times, meaning that for every $1 in current operating profit generated by Company C, investors are willing to pay $5.3 of firm value. If Company C is similar today to the expected steady state of Company B in Year 5, the 5.3-times-EBIT multiple

could be used to estimate the expected value of Company B at the end of Year 5, the terminal value.[12]

Table 4. Comparable companies to target company.

	Company C	**Company D**	**Company E**
Industry	Industry Z	Industry Z	Industry Z
Stage of growth	Mature	Mature	High Growth
EBIT ($ in thousands)	$3,150	$2,400	$750
Net earnings	1,500	1,500	150
Equity value	14,000	11,400	3,000
Debt value	2,800	3,000	3,500
Enterprise value	$16,800	$14,400	$6,500
Enterprise Value/EBIT	5.3	6.0	8.7
Equity Value/Net Earnings	9.3	7.6	20.0

To reduce the effect of outliers on the EBIT multiple estimate, we can use the information provided from a sample of comparable multiples. In sampling additional comparables, we are best served by selecting multiples from only those firms that are comparable to the business of interest on the basis of business risk, economic outlook, profitability, and growth expectations. We note that Company E's EBIT multiple of 8.7 times is substantially higher than the others in **Table 4**. Why should investors be willing to pay so much more for a dollar of Company E's operating profit than for a dollar of Company C's operating profit? We know that Company E is in a higher growth stage than Company C and Company D. If Company E profits are expected to grow at a higher rate, the valuation or capitalization of these profits will occur at a higher level or multiple. Investors anticipate higher future profits for Company E and consequently bid up the value of the respective capital.[13]

Because of Company E's abnormally strong expected growth, we decide that Company E is not a good proxy for the way we expect Company B to be in Year 5. We choose, consequently, to not use the 8.7 times EBIT multiple in estimating our terminal value estimate. We conclude instead that investors are more likely to value Company B's operating profits at approximately 5.7 times (the average of 5.3 and 6.0 times). The logic is that if investors are willing to pay 5.7 times EBIT today for operating profit of firms similar to what we expect Company B to be in Year 5, this valuation multiple will be appropriate in the future. To estimate Company B's

[12] We assume in this example that current multiples are the best proxies for future multiples. If there is some reason to believe that the current multiple is a poor or biased estimate of the future, the market multiples must be adjusted accordingly. For example, if the current profits are extraordinarily small or large, a multiple based on such a distorted value will produce an artificial estimate of the expected future value. A more appropriate multiple will use a nondistorted or "normalized" profit measure.

[13] See **Appendix** for an example of the relationship between market multiples and the constant-cash-flow growth model.

terminal value based on our average EBIT multiple, we multiply the Year 5 stand-alone EBIT of $2.156 million by the average comparable multiple of 5.7 times. This process provides a multiple-based estimate of Company B's terminal value of $12.2 million. This estimate is somewhat above the constant-growth-based terminal value estimate of $11.3 million.

While the importance of terminal value motivates the use of several estimation methods, sometimes these methods yield widely varying values. The variation in estimated values should prompt questions on the appropriateness of the underlying assumptions of each approach. For example, the differences in terminal value estimates could be due to:

1. a forecast period that is too short to have resulted in steady-state performance;
2. the use of comparable multiples that fail to match the expected risk, expected growth, or macroeconomic conditions of the target company in the terminal year; or
3. an assumed constant growth rate that is lower or higher than that expected by the market.

The potential discrepancies motivate further investigation of the assumptions and information contained in the various approaches so that the analyst can "triangulate" to the most appropriate terminal-value estimate.

In identifying an appropriate valuation multiple, one must be careful to choose a multiple that is consistent with the underlying earnings stream of the entity one is valuing. For example, one commonly used multiple based on net earnings is called the price-earnings or P/E multiple. This multiple compares the value of the equity to the value of net income. In a valuation model based on free cash flow, it is typically inappropriate to use multiples based on net income because these value only the equity portion of the firm and assume a certain capital structure.[14] Other commonly used multiples that are appropriate for free-cash-flow valuation include EBITDA (earnings before interest, tax, depreciation, and amortization), free cash flow, and total capital multiples.

Although the market-multiple valuation approach provides a convenient, market-based approach for valuing businesses, there are a number of cautions worth noting:

1. Multiples can be deceptively simple. Multiples should provide an alternative way to triangulate toward an appropriate long-term growth rate and not a way to avoid thinking about the long-term economics of a business.
2. Market multiples are subject to distortions due to market misvaluations and accounting policy. Accounting numbers further down in the income statement (such as net earnings) are typically subject to greater distortion than items high on the income statement. Because market valuations tend to be affected by business cycles less than annual profit figures, multiples can exhibit some business-cycle effects. Moreover, business profits are negative, the multiples constructed from negative earnings are not meaningful.

[14] Only in the relatively rare case of a company not using debt would the P/E ratio be an appropriate multiple.

3. Identifying closely comparable firms is challenging. Firms within the same industry may differ greatly in business risk, cost and revenue structure, and growth prospects.
4. Multiples can be computed with different timing conventions. Consider a firm with a December 31 fiscal year (FY) end that is being valued in January 2005. A trailing EBIT multiple for the firm would reflect the January 2005 firm value divided by the 2004 FY EBIT. In contrast, a current-year EBIT multiple (leading or forward EBIT multiple) is computed as the January 2005 firm value divided by the 2005 EBIT (expected end-of-year 2006 EBIT).[15] Because leading multiples are based on expected values, they tend to be less volatile than trailing multiples. Moreover, leading and trailing multiples will be systematically different for growing businesses.

Transaction multiples for comparable deals

In an M&A setting, analysts look to comparable transactions as an additional benchmark against which to assess the target firm. The chief difference between transaction multiples and peer multiples is that the former reflects a "control premium," typically 30% to 50%, that is not present in the ordinary trading multiples. If one is examining the price paid for the target equity, transactions multiples might include the Per-Share Offer Price ÷ Target Book Value of Equity Per Share, or Per-Share Offer Price ÷ Target Earnings Per Share. If one is examining the total consideration paid in recent deals, one can use Enterprise Value ÷ EBIT. The more similarly situated the target and the more recent the deal, the better the comparison will be. Ideally, there must be several similar deals in the last year or two from which to calculate median and average transaction multiples. If there are, one can glean valuable information about how the market has valued assets of this type.

Analysts also look at premiums for comparable transactions by comparing the offer price to the target's price before the merger announcement at selected dates, such as 1 day or 30 days, before the announcement. A negotiator might point to premiums in previous deals for similarly situated sellers and demand that shareholders receive "what the market is paying." One must look closely, however, at the details of each transaction before agreeing with this premise. How much the target share price moves upon the announcement of a takeover depends on what the market had anticipated before the announcement. If the share price of the target had been driven up in the days or weeks before the announcement on rumors that a deal was forthcoming, the control premium may appear low. To adjust for the "anticipation," one must examine the premium at some point before the market learns of (or begins to anticipate the announcement of) the deal. It could also be that the buyer and seller in previous deals are not in similar situations compared with the current deal. For example, some of the acquirers may have been financial buyers (leveraged buyout [LBO] or private equity firms) while others in the sample were strategic buyers (companies expanding in the same industry as the target.) Depending on the synergies involved, the premiums need not be the same for strategic and financial buyers.

[15] Profit figures used in multiples can also be computed by cumulating profits from the expected or most recent quarters.

Other Valuation Methods

Although we have focused on the DCF method, other methods provide useful complementary information in assessing the value of a target. Here, we briefly review some of the most popularly used techniques.

Book value

Book-value valuation may be appropriate for firms with, commodity-type assets valued at market, stable operations, and no intangible assets. Caveats are the following:

- This method depends on accounting practices that vary across firms.
- It ignores intangible assets like brand names, patents, technical know-how, and managerial competence.
- It ignores price appreciation due, for instance, to inflation.
- It invites disputes about types of liabilities. For instance, are deferred taxes equity or debt?
- Book value method is *backward-looking*. It ignores the positive or negative operating prospects of the firm and is often a poor proxy for market value.

Liquidation value

Liquidation value considers the sale of assets at a point in time. This may be appropriate for firms in financial distress, or more generally, for firms whose operating prospects are highly uncertain. Liquidation value generally provides a conservative lower bound to the business valuation. Liquidation value will depend on the recovery value of the assets (e.g., collections from receivables) and the extent of viable alternative uses for the assets. Caveats are the following:

- It is difficult to get a consensus valuation. Liquidation values tend to be highly appraiser-specific.
- It relies on key judgment: How finely one might break up the company: Group? Division? Product line? Region? Plant? Machines?
- Physical condition, not age, will affect values. There can be no substitute for an on-site assessment of a company's real assets.
- It may ignore valuable intangible assets.

Replacement-cost value

In the 1970s and early 1980s, during the era of high inflation in the United States, the U.S. Securities and Exchange Commission required public corporations to estimate replacement

values in their 10-K reports. This is no longer the case, making this method less useful for U.S. firms, but still is useful for international firms where the requirement continues. Caveats are the following:

- Comparisons of replacement costs and stock market values ignore the possible reasons for the disparity: overcapacity, high interest rates, oil shocks, inflation, and so on.
- Replacement-cost estimates are not highly reliable, often drawn by simplistic rules of thumb. Estimators themselves (operating managers) frequently dismiss the estimates.

Market value of traded securities

Most often, this method is used to value the equity of the firm (E) as Stock Price × Outstanding Shares. It can also be used to value the enterprise (V) by adding the market value of debt (D) as the Price Per Bond × Number of Bonds Outstanding.[16] This method is helpful if the stock is actively traded, followed by professional securities analysts, and if the market efficiently impounds all public information about the company and its industry. It is worth noting the following:

- Rarely do merger negotiations settle at a price below the market price of the target. On average, mergers and tender offers command a 30% to 50% premium over the price one day before the merger announcement. Premiums have been as high as 100% in some instances. Often the price increase is attributed to a "control premium." The premium will depend on the rarity of the assets sought after and also on the extent to which there are close substitutes for the technology, expertise, or capability in question, the distribution of financial resources between the bidder and target, the egos of the CEOs involved (the hubris hypothesis), or the possibility that the ex ante target price was unduly inflated by market rumors.
- This method is less helpful for less well-known companies with thinly or intermittently traded stock. It is not available for privately held companies.
- The method ignores private information known only to insiders or acquirers who may see a special economic opportunity in the target company. Remember, the market can efficiently impound only *public* information.

Summary Comments

The DCF method of valuation is superior for company valuation in an M&A setting because it:

[16] Since the market price of a bond is frequently close to its book value, the book value of debt is often used as a reasonable proxy for its market value. Conversely, it is rare that book value per share of equity is close enough to its market price to serve as a good estimate.

- Is not tied to historical accounting values. It is forward-looking.
- Focuses on cash flow, not profits. It reflects noncash charges and investment inflows and outflows.
- Separates the investment and financing effects into discrete variables.
- Recognizes the time value of money.
- Allows private information or special insights to be incorporated explicitly.
- Allows expected operating strategy to be incorporated explicitly.
- Embodies the operating costs and benefits of intangible assets.

Virtually every number used in valuation is *measured with error*, either because of flawed methods to describe the past or because of uncertainty about the future. Therefore:

- No valuation is "right" in any absolute sense.
- It is appropriate to use several scenarios about the future and even several valuation methods to limit the target's value.

Adapt to diversity: It may be easier and more accurate to value the divisions or product lines of a target, rather than to value the company as a whole. Recognize that different valuation methods may be appropriate for different components.

Avoid analysis paralysis: Limit the value quickly. Then if the target still looks attractive, try some sensitivity analysis.

Beyond the initial buy/no buy decision, the purpose of most valuation analysis is to support negotiators. Knowing value boundaries and conducting sensitivity analysis enhances one's flexibility to respond to new ideas that may appear at the negotiating table.

Appendix

METHODS OF VALUATION FOR MERGERS AND ACQUISITIONS

Description of Relationship between Multiples of Operating Profit and Constant Growth Model

One can show that cash-flow multiples such as EBIT and EBITDA are economically related to the constant growth model. For example, the constant growth model can be expressed as follows:

$$V = \frac{FCF}{WACC - g}$$

Rearranging this expression gives a free-cash-flow multiple expressed in a constant growth model:

$$\frac{V}{FCF} = \frac{1}{WACC - g}$$

This expression suggests that cash-flow multiples are increasing in the growth rate and decreasing in the WACC. In the following table, one can vary the WACC and growth rate to produce the implied multiple.

		WACC		
		8%	10%	12%
Growth	0%	12.5	10.0	8.3
	2%	16.7	12.5	10.0
	4%	25.0	16.7	12.5
	6%	50.0	25.0	16.7