

Valuing Synergies

THE CONCEPT OF SYNERGY WHEN ONE THINKS LIKE AN INVESTOR

The word *synergy* derives from an ancient Greek word meaning to cooperate or to work together. Where synergy happens, the whole is greater than the sum of the parts, the so-called $2 + 2 = 5$ effect. The concept is demonstrated in numerous fields. For instance, in medicine, synergy results when two drugs taken in concert produce an effect greater than the sum of effects of each one taken alone. In sports and the performing arts, synergy can be observed in superior teamwork.

In business, the opportunities for synergy are legion. Often, the synergies are expressed in vague strategic or organizational terms. The inability to express the benefits in measurable terms is the telltale of future difficulties. Mark Sirower, a vice president at Boston Consulting Group, noted that “The easiest way to lose the acquisition game is by failing to define synergy in terms of real, measurable improvements in competitive advantage,”¹ such as cash flows. This chapter defines synergies in economic terms and illustrates how you can value them.

Some benefits of a merger merely duplicate what shareholders can do on their own. These can hardly be expected to lift the buyer’s stock price. Value creation is the toughest, and best, gauge of synergies. The key idea in this chapter is that *true synergies create value for shareholders by harvesting benefits from merger that they would be unable to gain on their own*. Shareholders can combine shares of publicly traded firms in their own portfolios. Why should they pay managers to do this for them if they can easily do it themselves?

Some will point out that the vast bulk of M&A transactions occur among privately held firms in whom ordinary investors cannot take positions through the public equity market. Others will point to the growing tide of cross-border deals, which present estimable barriers of information and trading to the ordinary investor. In arenas such as these, it may be true that investors cannot do these deals on their own. But even here, the investor’s point of view gives extremely valuable guidance: One can still apply it *as if* public investors could take positions in the combining firms.

Synergy defined from the perspective of the investor is the toughest definition since it controls for so many potentially false sources of benefit. Recall the seven criteria for thinking like an investor that were outlined in Chapter 9: look to the future, focus on cash flow, get paid for risks, account for the time value of money and opportunity cost, consider any information advantages, and diversify efficiently.

While controlling for all of these elements still may not guarantee the correct decision about a deal, failing to control for them increases the odds of a bad decision.

SYNERGY ESTIMATES MUST BE A CENTRAL FOCUS OF M&A ANALYSIS

Synergy assessment should be the centerpiece of M&A analysis for four reasons. First, value creation should be a fundamental aim of M&A transaction design. Managers, as agents of investors, should think like investors. While there is no guarantee that even the best-designed deal will ultimately create value (see, for instance, the challenges of postmerger integration discussed in Chapter 36) the odds are that a deal having no foreseeable synergies at closing will destroy value in the long run—certainly such a deal will do nothing for investors that they cannot do for themselves.

Second, assessing synergies addresses an extremely important tactical problem for the deal designer: anticipating the likely investor reaction to the announcement of the deal. If the buyer is perceived to have overpaid for the target, the buyer's share price will fall at the announcement of the deal. But in the presence of true synergies, as defined in this chapter, the buyer's share price might rise, depending on the relationship between price and value of the target (V_{Target}) plus value of synergies ($V_{\text{Synergies}}$).

<i>Buyer's Share Price Will:</i>	<i>If This Equation Is Satisfied</i>
Rise	$\text{Price} < V_{\text{Target, stand-alone}} + V_{\text{Synergies}}$
Not change	$\text{Price} = V_{\text{Target, stand-alone}} + V_{\text{Synergies}}$
Fall	$\text{Price} > V_{\text{Target, stand-alone}} + V_{\text{Synergies}}$

Two of the three variables in this equation are easily observable. The deal announcement will reveal the deal price. The value of a publicly owned target before the offer can be observed and is easily assumed to be the *stand-alone value*. By valuing the synergies expected to be created in the deal, the analyst can anticipate the reaction of investors to the announcement (i.e., buy, sell, hold). Anticipating their reaction is important to deciding about the use of collars, caps, floors, and other transaction risk management tactics.

Here's a case in point: in 1978, Brown-Forman Distillers Corporation announced the acquisition of Southern Comfort Corporation for \$94.6 million—my own analysis suggested that this was a full price for the target on a stand-alone basis. The target was the producer of a sweet liqueur by the same name. The buyer was (and is) a leading producer of distilled spirits, notably "Jack Daniel's," a rapidly growing brand and the highest-priced American whiskey of any notable volume. Analysts and investors believed that Brown-Forman would carry its brand-management expertise to an undermanaged brand that had high growth potential and that the acquisition would use Brown-Forman's financial slack: in short, the deal would create revenue and financial synergies. In response to the announcement, investors bid up the

price of Brown-Forman shares by 14.1 percent over the return on the S&P 500 Index (in dollar terms, \$61.5 million)—this gain lasted. Using the framework on the preceding page, given that price and stand-alone value were roughly equal, Brown-Forman's share price must have risen because the synergies were worth \$61.5 million.²

Third, valuing the synergies in a deal can help the analyst develop a strategy for disclosing those synergies to the investors and shaping their understanding of them. Investors will want to know about the possible sources of synergy value, their relative certainty of realization, their duration, and their magnitude. Some executives choose to disclose only the most certain synergies in any detail. Others will choose to offer guidance to analysts and investors about the less certain synergies, too. But any disclosure strategy should be informed by an understanding of the possible value attached to deal synergies.

Finally, valuing synergies should be a foundation for developing a strategy for postmerger integration. Managers should tailor integration plans to deal with the points of greatest impact and leverage in realizing synergy value. Valuation analysis can illuminate the path.

A FRAMEWORK FOR SYNERGY ANALYSIS

The rigorous analysis of synergy value must begin with a careful inventory of its sources. The valuation framework outlined in Chapters 9 and 10 affords an organizing scheme: synergies as a bundle of two types—synergies “in place” and *real option synergies*:

$$V_{\text{Synergies}} = V_{\text{synergies}}^{\text{In place}} + V_{\text{synergies}}^{\text{Real options}} \quad (1)$$

This approach follows the work of Stewart C. Myers,³ who decomposed firm value into the value of “assets-in-place” and “growth options.” Valuation approaches illuminate each of the terms on the right-hand side of the equation.

Synergies from Assets or Activities That Are In Place

The first class of synergies derives from assets or activities whose payoffs are reasonably predictable. Discounted cash flow valuation is the best approach for valuing streams of cash generated from these synergies. The framework of DCF valuation casts the drivers of synergy value into useful form. Recalling the discussion in Chapter 9, a standard formula for DCF valuation of synergies is:

$$V_{\text{Synergies in place}} = \sum_{t=0}^n \frac{\text{FCF}_t}{(1 + \text{WACC})^t} \quad (2)$$

Free cash flow (FCF) is the after-tax operating profit, plus noncash deductions, less investments in net working capital and capital projects. The weighted average cost of capital (WACC) is the blended opportunity cost of all investors.

The DCF formula implies that synergies in place can arise from improvements in any of the FCF components or in WACC. Implied in FCF or WACC are *improvements in timing*, shown by the “*t*” in the formula. These improvements, however, need to be scrutinized. They include:

REVENUE ENHANCEMENT SYNERGIES Newco sells more product than either of the two firms would have sold independently. Typically, these *revenue enhancements* are envisioned to arise from cross-selling by the two firms’ sales forces, or cross-branding (or rebranding) between the target’s and buyer’s products. For instance, when Eli Lilly, a large pharmaceuticals firm, acquired Hybritech Inc., a small biotech boutique, in 1986, it foresaw the ability to channel Hybritech’s pathbreaking products through Lilly’s large and efficient marketing force. The increase in product sales resulting from this combination was a classic synergy.

COST REDUCTION SYNERGIES Newco’s unit costs decline as a result of the transaction. Sources of *cost reductions* include economies of scale arising from higher capacity utilization of existing plant and equipment, greater purchasing power vis-à-vis suppliers, the elimination of intermediaries in a supply chain, the improvement in logistics and distribution, closing the target’s headquarters and managing Newco without an offsetting increase at the buyer’s headquarters, and the transfer of technology or know-how from one firm to the other. Of all the sources of synergy, this appears to be the most credible. A study of bank mergers by Houston and Ryngaert yielded the conclusion that “the market is readily persuaded by the cost-cutting motive for mergers, while subjecting other rationales to considerable skepticism.”⁴

ASSET REDUCTION SYNERGIES Combining two firms may permit the disposal of idle assets, such as vacant real estate, a redundant headquarters building, unused plant capacity, and excess inventories, receivables, or cash balances. These *asset reductions* represent real economic benefits, though the analyst should be reminded that these are typically one-shot events, not recurring through time.

TAX REDUCTION SYNERGIES Acquisitions can unlock two kinds of *tax reduction* synergies that investors would not have been able to achieve on their own. The first is the exploitation of an increase in depreciation tax shields deriving from the step-up in basis following a purchase transaction. The second is the de facto transfer of net operating losses (NOLs) from a target to a buyer through merger or acquisition. This is a “ $2 + 2 = 5$ ” transaction if the target were unable to fully use these losses to reduce tax expense before the expiration of those tax losses. The carryforward of operating losses to apply against future earnings usually has a finite life. By combining with a profitable firm, it may be possible for the target’s NOLs to be fully used, or used more quickly than on a stand-alone basis. The step-up in basis with purchase transactions may permit the buyer to exploit depreciation tax shields that would not otherwise exist. The full and/or faster use of tax shields that investors cannot replicate is a genuine synergy. In contrast, a tax reduction that may not be a synergy involves the exploitation of debt tax shields through financing the transaction, discussed next.

FINANCIAL SYNERGIES One must exercise caution in evaluating synergies that are claimed to reduce Newco's weighted average cost of capital. The key idea is that if financing creates value for investors that they cannot create for themselves, then it is a synergy; otherwise not. There are two classic WACC *reduction* arguments, one of which probably meets this synergy definition, and the other of which probably does not.

Reducing WACC by Optimizing the Use of Debt Tax Shields As discussed in Chapter 9, the use of interest-bearing debt to finance the firm reduces the firm's tax expense. But if investors can borrow on their own, simply financing a deal with debt doesn't do anything for investors that they cannot do themselves. The operative word here is "if"—individual investors may find it difficult to borrow in sufficient amounts, and at rates as advantageous as those received by the larger corporations. The difference between corporate and individual borrowing terms may not be trivial, but if the attractiveness of a deal hinges on this difference, it may not be worth doing. One must remember that beyond some reasonable amount of leverage, adding more debt does not create more value, and indeed, may destroy it. Helping an overlevered target return to more moderate use of debt financing might create value.

In 1995 Craig McCaw sold McCaw Cellular Communications to AT&T. At the time, McCaw's debt carried a CCC rating, while AT&T's carried AA. McCaw was constrained in the amount of financing it could obtain to build out its national wireless telecommunications business; AT&T was virtually unconstrained. A naive analyst might have looked at this deal as an opportunity to exploit AT&T's creditworthiness in pursuit of the expansion of McCaw. But AT&T shareholders would almost certainly want to be compensated for the deterioration in their credit rating that would ensue from financing McCaw, so it looked like a dubious synergy. Also, there may be an adverse interaction between operating synergies (revenues, costs, assets) and default risk reduction that reduces Newco's WACC.

In theory, managers should strive to finance their firms with an optimal mix of debt and equity—a "Goldilocks" blend of not too much or too little debt. But some managers choose not to do so, perhaps out of ignorance or a failure to be faithful agents to the interests of investors. Some raiders take this as a cue to take over the target and leverage it more optimally. Kirk Kerkorian's two attempts to gain control of Chrysler are examples of the effort to optimize the financing of the firm. But this is an action that investors may be able to accomplish on their own through homemade leverage. In short, WACC *optimization* usually will not meet the economic definition of synergy.

Coinurance Effects: Shifting the Curve The theory of portfolio diversification suggests that combining two cash flow streams that are less than perfectly correlated can produce a joint stream that is less risky than a simple sum of the streams would imply.

Wilbur Lewellen (1971) used this argument to show that the joint probability of financial distress would be lower for Newco than would be the simple average of the probabilities (assuming that the returns of the two firms have a correlation of less than 1.00). This reduction of risk lowers the risk per unit of cash flow (again assuming no change in the earnings stream of the firms), which makes the surviving firm more attractive to creditors and equity investors; in effect, the

merging firms *coinsure* the obligations of Newco, making them less risky to lenders. Lewellen argued that coinsurance cannot create value for shareholders by reducing the cost of capital (remember that shareholders can already do this on their own) but it *could create additional borrowing capacity* for Newco. By using this capacity (borrowing more) one exploits debt tax shields more and creates value for shareholders.

Robert Merton and Andre Perold⁵ note that the covariability of returns among different business activities can be exceedingly complex to track, rendering the rigorous estimation of *coinsurance effects* quite difficult.

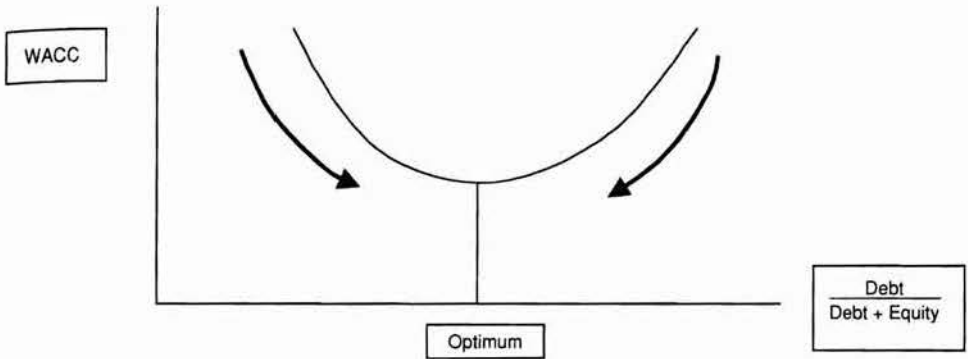
In summary, the story on financial synergies is that they are reflected best in *access to capital*, in shifting the WACC curve in advantageous ways—of changing the rules of the game, so to speak. See Exhibit 11.1 for a graphic depiction of how WACC curves may shift. More debatable WACC synergies arise from optimizing the WACC curve as it is—here the investors' abilities to “home-make” their own financing for firms must be given some consideration. Even though investors may not enjoy the same financing terms as corporations, the fact that they can partially exploit the benefits on their own should prompt the analyst to scrutinize skeptically claims of genuine WACC synergies. Best practice should place a high burden of proof on analysts claiming the existence of financial synergies.

Real Option Synergies

The other class of synergies depends on some triggering event to produce a payoff. These are *real option synergies*. In essence, options that create flexibility for managers or extract commitments from others will convey positive value. Consider these possibilities:

- **Growth option synergies.** These would arise from the combination of resources in a transaction that create the right but not the obligation to grow. Examples of this would include R&D or creative capabilities, the matching of licenses to enter new markets with the resources to do so, leases on land or mineral reserves, and access to an information base or network.
- **Exit option synergies.** A merger might make Newco less *path dependent*, giving the firm more alternatives to respond to market conditions as they change or to alter investment strategies.
- **Options to defer.** A combination of two firms could grant the flexibility to wait on developing a new technology, entering a new market, or undertaking some other risky action.
- **Options to alter operating scale (i.e., expand, contract, shut down, and restart).** A combination of two firms could help the buyer to exit or enter a business more readily.
- **Options to switch.** These would include the ability to change the mix of inputs or outputs of the firm, or its processes. The acquisition of Maxus Energy by Yacimientos Petroliferos Fiscales S.A. (YPF) in 1995 permitted YPF to source oil from a wider range of reserves, permitting it greater flexibility in supply.

Investors may be able to optimize WACC on their own,
through homemade leverage



But combination of the buyer and target could cause the
WACC curve to shift in advantageous ways

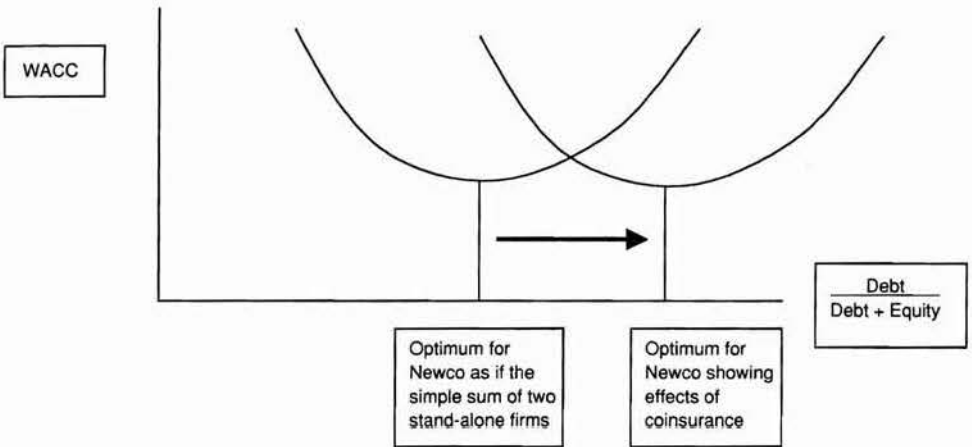


EXHIBIT 11.1 How WACC Curves May Shift

To illustrate the effect of these synergies, Ron Mitsch, former vice chairman of 3M Corporation, told me about 3M's acquisition of "enabling technologies." He said,

In the 1960s Roger Appledorn invented the Fresnel lens for use in overhead projectors. In the early 1980s he expressed his vision and foresight that "microreplication" represented a broad-based technology platform that could lead to hundreds of millions of dollars of growth in several market areas. He also

described clearly the capabilities and enablers we had to have to make it happen. So we put in place the internal programs needed, and complemented them with necessary licenses, acquisitions, and alliances, and invested capital in enabling process capabilities. At that time we did not know for sure whether it would pay off or not—but today one only has to read the 3M annual report to realize how important Roger Appledorn's vision and "microreplication" are to the company.⁶

The acquisition of enabling technologies could create a variety of options. These are sources of value, and need to be assessed in gauging the economic impact of a deal.

ESTIMATING SYNERGY VALUE, WITH EXAMPLES

The valuation framework offers a foundation for the valuation of the deal synergies. Steps for approaching the two types of synergy are discussed in detail in Chapters 9 and 10. Experience shows, however, that novice analysts frequently ignore a few important issues in synergy valuation; they deserve to be reiterated here.

Crucial Foundation: Establish Credibility of the Synergy Source

Everything depends on the economic foundation for the synergy. This requires careful due diligence and research. All too often synergies that are touted at the announcement of a deal are based on mere guesswork. Worse, they can be dictated having been identified as the synergies necessary to make the deal succeed without really determining how they would be achieved.

Everything after Tax

Most revenue and cost synergies reported by line managers will be *pretax*, as is usually the case in reports of expected synergies in filings to the Securities and Exchange Commission (SEC). These will need to be adjusted to reflect the *marginal* tax rate of Newco. Asset reduction synergies may entail a profit or loss on the disposition of the asset—these, too, must be adjusted for the marginal tax rate of Newco. WACC-related synergies must reflect the marginal tax rate also.

Choose a Discount Rate Consistent with the Risk of the Synergy

The synergies outlined in this chapter differ in risk. Operating managers typically will assert that cost synergies are most certain and revenue synergies least certain. Tax reduction and asset reduction synergies are probably even more certain than others. WACC synergies are probably in between. The difference in risk may be material enough to warrant using different discount rates to evaluate the synergy benefits. After all, one of the most important tenets of financial economics is that

one should value a stream of cash using a discount rate consistent with the risk of that stream. If, as practitioners tell us, the different synergies have different degrees of risk, then using different discount rates seems sensible.

Theory offers no detailed suggestions for which discount rate to use in valuing different kinds of synergy cash flows. The analyst must rely on judgment and intuition instead. Here are a range of possibilities:

- “Sure things” should be discounted at the risk-free rate. For instance, the cash flow from selling redundant raw material inventory into a liquid market with quotable prices (such as steel) might fall in this category.
- Cash flows that are as variable as EBIT could be discounted at the cost of debt. The interest expense charged by lenders in effect prices the uncertainty impounded in EBIT.
- Cash flows that are as risky as the free cash flows of the enterprise should be discounted at the firm’s weighted average cost of capital (WACC).
- Cash flows that are as risky as the residual cash flows of the firm (such as dividends and share repurchase flows) should be discounted at the firm’s cost of equity.
- Cash flows that are as speculative as a venture capital investment should be discounted at the venture capitalists’ required rate of return (e.g., 30 percent or higher).

Exhibit 11.2 gives a graphical representation of the spectrum of synergies and the discount rates consistent with their risks.

The whole point of tailoring the discount rate to the type of synergy is to *adjust for risk*. An alternative approach is to use a prescribed discount rate like the WACC, and to give the synergy cash flows a “haircut” if they seem riskier than the WACC would imply—but doing so is even *more* arbitrary than selecting a discount rate. How large a haircut should you give? The haircut method is vulnerable to the analyst’s biases. It is better to work within a range of discount rates suggested by the capital markets. Here, for instance, is an excerpt of Merrill Lynch’s valuation of synergies produced in the acquisition of Quaker Oats by PepsiCo.

Merrill Lynch performed a discounted cash flow analysis of the expected synergies based upon the estimates provided by PepsiCo. The discounted cash flow valuation was calculated assuming discount rates ranging from 10.0% to 12.0% and was comprised of the sum of the present values of: (1) the projected after-tax synergies for the years 2001 through 2012; and (2) the terminal value of the expected synergies in 2012, utilizing a range of perpetuity growth rates of 1.0% to 3.0%. Based upon this discounted cash flow analysis, Merrill Lynch valued the expected synergies at a range of \$11.35 to \$16.85 per Quaker share.⁷

The use of a *range* of discount rates at least expresses professional honesty: When you don’t have a strong basis for asserting the relevance of a given rate, then it is appropriate to disclose your uncertainty and use a range of rates consistent with capital market information. No matter what, choose discount rates with caution.

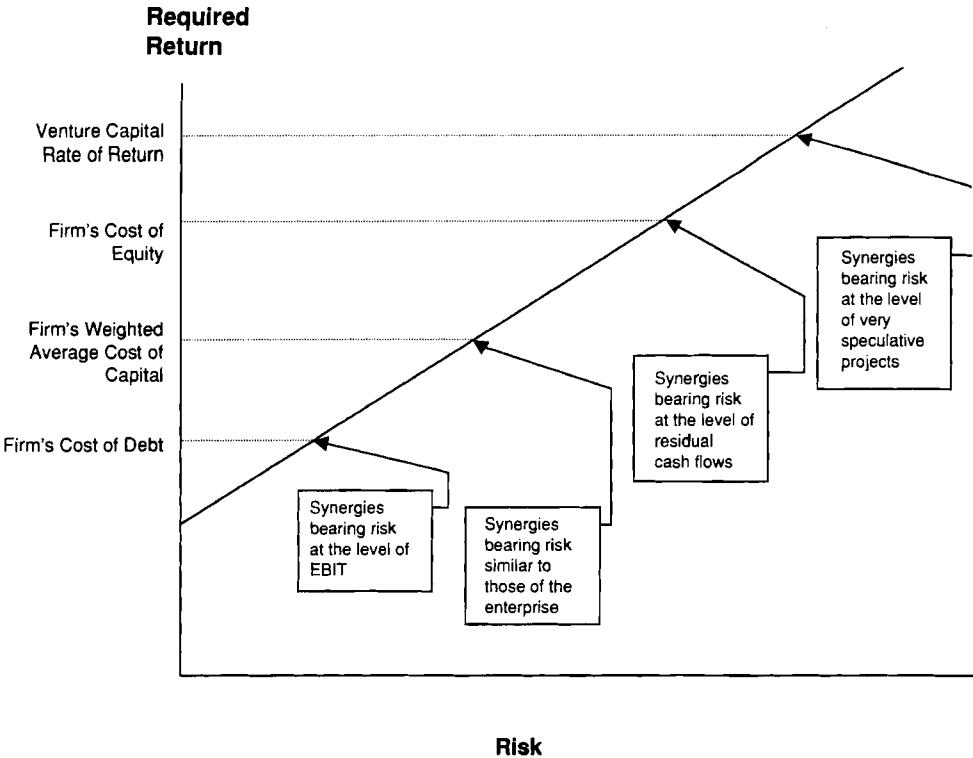


EXHIBIT 11.2 Tailor the Discount Rate for Synergies to Their Risk

The practical conclusion of all this is that the professional M&A analyst should start from the WACC (if valuing the target as an enterprise) or cost of equity (if valuing the target's equity) and then prepare to adjust the discount rate for synergies upward or downward to reflect the analyst's judgment about the degree of risk in those synergies.

Reflect Inflation, Real Growth, and a Reasonable Life

Most synergy estimates are at best one-year forecasts. Yet the reality is that synergies in costs, taxes, WACC, and revenues could continue for a long time. One must capture the entire expected life of the synergies. The discounted cash flow framework can give a means of valuing these synergies. The venerable constant growth model can capitalize a perpetually growing synergy stream.

Growth of synergy begs scrutiny of the rate. As Chapter 9 suggests, this growth rate can be modeled as the product of inflation and real growth, in a Fisher Equation. One must weigh the prospect for both sources of growth. Revenue synergies are almost certainly subject to both forms of growth. But cost synergies may or may not be. Tax and WACC synergies are probably unaffected by real growth, and maybe even inflation. Asset reduction synergies, largely being one-time or short-term benefits, are also unaffected.

Use a Terminal Value to Reflect Extended Life of Synergies

Terminal value is frequently overlooked or assumed to be nil out of an arbitrary sense of conservatism. Of course, one should always scrutinize the assumption that cost savings can be sustained indefinitely. But if they can, then including a terminal value is essential. This terminal value can be estimated using the approaches described in Chapter 9—the constant growth valuation model is perhaps the best to use because it permits closer scrutiny of the effect of variations in basic assumptions.

Be Flexible: $X(A + B) = XA + XB$

Adapt the assessment of synergies to the problem at hand. Some analysts prefer to enter the synergy effects into the valuation of the entire firm, thus producing different case results. Other analysts prefer to estimate separately the stand-alone value of the firm and synergy values. *These two approaches should yield the same estimate of the value of the firm with synergies*, under the basic principle of algebra: $X(A + B) = XA + XB$.

$$PV(CF_{\text{Alone}} + CF_{\text{Synergies}}) = PV(CF_{\text{Alone}}) + PV(CF_{\text{Synergies}}) \quad (3)$$

“PV” stands for “present value of . . .” and is the discounting operator. “CF” stands for cash flow.

The equivalence of these two approaches permits the analyst to tailor the approach to the requirements of the situation. The disaggregated approach will be useful where one needs to isolate the synergy effects for clarity. The aggregated approach will be useful where one wishes to show the impact of synergies on the total financial results of Newco.

Example: Valuing Cost Saving and Asset Reduction Synergies

Suppose that managers anticipate cost savings pretax of \$50 million in the first year of the deal, and \$100 million the next, and that thereafter the savings would grow at the rate of inflation, 2 percent. The marginal tax rate is 40 percent. The firm must invest \$1 billion to achieve these savings, and starting in the third year, must spend 5 percent of the pretax savings to sustain the rate of savings. As part of the rationalization of operations, some assets will be sold, generating a positive cash flow of \$20 million net of tax in years 1 and 2, and \$10 million in year 3. The analyst judges that these cost savings are *rather certain*, reflecting a degree of risk consistent with the variability in the firm's EBIT. Accordingly, the analyst decides to discount the cash flows at the firm's cost of debt of 6 percent.

Exhibit 11.3 lays out the flows of cash associated with the cost savings and asset reduction. Discounted at the rate of 6 percent, the present value of these flows is \$428 million. The internal rate of return on the outlays associated with the restructuring is 15 percent. Note that the bulk of this synergy value derives from the terminal value.

Example: Valuing Revenue Enhancement Synergies

In this example, managers conclude that the combination of two firms will expand revenues through cross-selling of products, efficient exploitation of brands,

EXHIBIT 11.3 Example: Valuing Cost Savings and Asset Reduction Synergies

	Year					
	0	1	2	3	4	5
1 Pretax cost savings, constant dollars		\$50	\$100	\$100	\$100	\$100
2 Expected inflation rate		2%	2%	2%	2%	2%
3 Growth rate of FCF (nominal), in perpetuity	2%					
4 Discount rate	6%					
5 Ongoing investment/savings (year 3+)	5%					
6 Pretax cost savings, current dollars		\$51	\$104	\$106	\$108	\$110
7 Tax expense (@ .40)		(20)	(42)	(42)	(43)	(44)
8 After-tax cost savings		31	62	64	65	66
9 Less: investment necessary to realize the savings	\$(1,000)			(5)	(5)	(6)
10 Plus: disinvestment associated with the savings		20	20	10	—	—
11 Subtotal	(1,000)	51	82	68	60	61
12 Terminal value						1,548
13 Free cash flow	\$(1,000)	\$51	\$82	\$68	\$60	\$1,609
14 Net present value of cost savings	\$428					
15 Internal rate of return of synergy investment	15%					

and geographic and product line extension. They forecast revenue growth of \$100 million in the first year and \$200 million in year 2 and thereafter. The cost of goods underlying these new revenues is 45 percent of the revenues. This forecast is in constant dollar terms and needs to reflect expected inflation of 2 percent per year. To achieve these synergies will require an investment of \$400 million initially, and 5 percent of the added revenue each year, to fund working capital growth.

Exhibit 11.4 gives the cash flows associated with the revenue enhancements (assuming a higher degree of risk on the new revenue-generating activities). Discounted at the firm's cost of equity, the present value of these flows is \$50 million, with an internal rate of return (IRR) of 18 percent.

Example: Valuing Financial Synergies

The simplest financial synergy to value is an expansion of Newco's debt capacity beyond the simple sum of the buyer and target firms. This arises from Lewellen's coinsurance effect. Assuming Newco increases its borrowings to the new, higher optimum, then the gain in value is simply the present value of additional debt tax shields. Under assumptions outlined in Chapters 9 and 13, this could be estimated simply as the marginal tax rate times the increased perpetual debt outstanding.

As noted earlier, the other form of financial synergy, WACC reduction, should be valued cautiously and skeptically, for it assumes that financial securities of the

EXHIBIT 11.4 Example: Valuing Revenue Enhancement Synergies

		Year					
		0	1	2	3	4	5
1	Revenue enhancements, constant dollars		\$100	\$200	\$200	\$200	\$200
2	Expected inflation rate		2%	2%	2%	2%	2%
3	Growth rate of FCF (nominal), in perpetuity	3%					
4	Discount rate	15%					
5	Ongoing investment/revenue (year 1+)	5%					
6	Operating cost/revenues	45%					
7	Revenue enhancements, current dollars		\$102	\$208	\$212	\$216	\$221
8	Operating costs to support revenue enhancements		(46)	(94)	(96)	(97)	(99)
9	Tax expense (@ .40)		(22)	(46)	(47)	(48)	(49)
0	After-tax cost savings		34	69	70	71	73
1	Less: investment necessary to realize the added revenue	\$(400)	(5)	(10)	(11)	(11)	(11)
2	Plus: disinvestment associated with the revenue		10	5	—	—	—
3	Subtotal	(400)	39	63	59	61	62
4	Terminal value						\$531
5	Free cash flow	\$(400)	\$ 39	\$ 63	\$ 59	\$61	\$593
6	Net present value of cost savings	\$50					
7	Internal rate of return of synergy investment	18%					

buyer and target are inefficiently priced. To illustrate where the inefficiency occurs, consider the following case. Suppose that managers believe that a combination of the two firms will reduce the risk of the combined enterprise more than investors could achieve through simple portfolio diversification. This belief springs from the fact that one of the firms holds secret proprietary processes that are unknown by public investors. These processes will dampen the volatility of earnings. Analysts believe that this volatility reduction equates to a reduction in the asset beta of Newco of -0.10 from a simple weighted average of the asset betas of the two firms. The key assumption here is that the equity market does not anticipate this reduction.

Exhibit 11.5 shows the calculations associated with this asset beta reduction. Line 4 of the exhibit calculates the dollar cost of capital of Newco with and without the asset beta reduction. Line 5 shows the annuity value of this saving. In the exhibit, the unexpected reduction of asset beta yields a decrease in WACC by 60 basis points, worth \$77 million if Newco's market value of capital is \$12 billion. The present value of this annual saving is \$760 million. As the example suggests, it does not require much of a reduction in asset beta to produce a material financial synergy. But the analyst should always approach projections of such synergies very cautiously. Although, as Chapters

EXHIBIT 11.5 Valuing Financial Synergies

	Buyer (Before)	Target (Before)	Sum of Buyer and Target (Before)	Newco	Value Impact
1 Weighted average cost of capital, before the acquisition	10.2%	11.2%	10.7%		
2 Newco's weighted average cost of capital, after the acquisition				10.1%	
3 Total capital of buyer and target, before the acquisition	\$6,000	\$6,000		\$12,000	
4 Dollar cost of capital	\$612	\$674	\$1,286	\$1,209	\$77
5 Implied present value of financial synergies from acquisition					\$760
Calculation of Newco's Cost of Capital after Acquisition					
6 <i>Cost of equity estimate</i>	12.0%	15.5%		12.6%	
7 Beta of buyer, before the acquisition	1.00				
8 Beta of target, before the acquisition		1.50			
9 Unlevered beta	0.83	1.01		0.92	
10 Adjustment in Newco asset beta because of covariance unanticipated by market				-0.10	
11 Market value weight of buyer in Newco (%)	50%				
12 Market value weight of target in Newco (%)		50%			
13 Beta of Newco				1.08	
14 Risk-free rate of return	0.05	0.05		0.05	
15 Equity market risk premium	0.07	0.07		0.07	
16 Cost of equity from CAPM	12.0%	15.5%		12.6%	
17 <i>Cost of debt estimate</i>	4.8%	6.0%		5.4%	
18 New rating associated with Newco's target capital structure	AA	BBB		A	
19 Average maturity of debt associated with target capital structure (in years)	7	7		7	
20 Current <i>pretax</i> yields on debt, at rating and tenor of Newco	8.0%	10.0%		9.0%	
21 Marginal tax rate for Newco	40.0%	40.0%		40.0%	
22 After-tax cost of debt for Newco	4.8%	6.0%		5.4%	
Weights in target capital structure for Newco					
23 Targeted weight of debt (%)	25%	45%		35%	
24 Targeted weight of equity (%)	75%	55%		65%	

4 and 20 show, inefficient valuation of securities can occur at peaks of the M&A cycle, and claims of inefficiency are easily abused. Best practice imposes a high burden of proof on analysts who place much emphasis on likely WACC reduction synergies.

Example: Valuing Real Option Synergies

Options values are driven by six parameters: price of the underlying asset, exercise price, term of the option, volatility of returns on the underlying asset, the risk-free rate of return, and dividends, if any. Here's an illustration. Suppose you are considering acquiring a small, profitable technology firm, which has just obtained patents on a new process that *might* be applicable to your business. You won't know how useful these processes will be until you buy the firm and invest in a little more development research. Your estimate of the intrinsic value of the target, based on its *predictable, expected* cash flows, is \$100 million. The seller won't settle for less than \$120 million. On the basis of what is known right now, the deal looks like a loser if there are no real option synergies:

$$\text{Price} > V_{\text{cash flows}}^{\text{Expected}} + V_{\text{synergies}}^{\text{Contingent}} \quad (4)$$

$$\$120 \text{ mm} > \$100 \text{ mm} + ? \quad (5)$$

But it is possible that the acquisition of the new process technology might create an opportunity to extract more synergy value from the combination of the two firms. What is the real option synergy value worth?

The acquisition grants the buyer a right to apply the new process technology. Casting the acquisition of enabling technologies into this framework yields the drivers shown in Exhibit 11.6. Suppose that for the sake of simplicity,⁸ you decide to model this synergy value as a simple call option. Inserting the parameters into the Black-Scholes option pricing model ("Option Valuation.xls," found on the CD-ROM) yields a relatively large real option synergy value, \$28.06 million. This may seem counterintuitive, since the option is deeply out of the money. A little sensitivity analysis reveals that the high option value derives from the relatively long term and very high volatility of the technology. In other words, what makes the synergy value from acquiring the enabling technology so large is the good chance that the option will be in the money someday (i.e., the good chance derives from the option's long life and high volatility).

The real option synergy value turns the acquisition into a winner. Your estimated value of the target is now higher than the asking price:

$$\text{Price} < V_{\text{cash flows}}^{\text{Expected}} + V_{\text{synergies}}^{\text{Contingent}} \quad (6)$$

$$\$120 \text{ mm} < \$100 \text{ mm} + \$28.06 \text{ mm} \quad (7)$$

Example: Backsolving for the Required Synergies from the Acquisition Premium

The uncertainty surrounding most synergy estimates will make decision makers uncomfortable and even cynical about these estimates. Skepticism is a useful attitude when assessing synergies, but it can also blind decision makers to the possibilities in

EXHIBIT 11.8 Illustration of Valuing an Enabling Technology as a Call Option

Option Value Driver	Application to Acquisition of Enabling Technology	Parameter
Price of underlying asset	This is the present value of expected future cash flows from the new technology. Suppose your analysts say that this product line could yield cash flows of as much as \$2 billion per year. But you are a realist, and make decisions on present expected values. You ascribe a present expected value of \$50 million to the new technology, based on what you know today.	\$50 million
Exercise price	To actually commercialize the new technology, if and when you choose to do it, will take an investment of \$500 million.	\$500 million
Dividends	If you were to exercise this option immediately, it would start throwing off some cash. By waiting, you forgo the cash flow. Incorporating the forgone dividend from this technology into your assessment is important. The dividends reflect your impatience to exercise the option out of a concern for being first, not getting scooped, or defining the market. You guess that the cash flow would be \$3 million per year initially, and that it would vary with the volatility of returns.	\$3 million
Term	Patent protection gives you an exclusive right to exploit this synergy. If you add in the nonexclusive period thereafter, this is a potentially very long-lived option. Offsetting this is the rate of technological innovation in the field. Your best guess is that this technology will dominate others for a shorter period, such as 10 years.	10 years
Volatility	The uncertainty about the returns from this project is huge as the discussion of price of the underlying asset implies. Your staff runs a Monte Carlo simulation of IRRs on the enabling technology, and concludes that the standard deviation of returns is about 80%. You choose 80% because it is very much higher than the volatilities for more stable investments.	80%
Risk-free rate	The yield on the 10-year U.S. Treasury bond is 7 percent. You choose a bond whose life is contemporaneous with the life of the option.	7%
Real option synergy value from acquiring the enabling technology		\$28.06 million

a deal. One way to address the problem is to reverse the inquiry and ask, *what synergies are necessary to make this an economically attractive deal given the price necessary to do the deal?* This synergy value can then be backsolved for the pretax cost savings, asset reductions, revenue enhancements, financial synergies, and contingencies necessary to produce that value. Operating managers and chief executives generally find it easy to assess the likelihood of achieving annual improvements in costs, revenues, and reductions in assets. In other words, the backsolving approach helps managers test the feasibility of synergies required to justify the deal.

The personal computer and a spreadsheet program make backsolving relatively easy. The program “Valuing Synergies.xls,” found on the CD-ROM, contains the basic examples given in the preceding sections. Excel spreadsheet software contains two tools that are useful in the backsolving exercise. The first is “Goal Seek,” which varies the value in an assumption cell until a formula that depends on that cell yields the result you want. The second is “Solver,” which varies more than one cell used in a formula to produce the result you want.

To illustrate the backsolving process using the “Goal Seek” feature, reconsider the cost saving synergy example given earlier in this chapter. Suppose that the deal designer needs a present value of synergies of at least \$1 billion in order to justify a deal. The analyst should click on “Tools” and “Goal Seek,” and then at the prompt indicate the cell address for the NPV of synergies, the target amount (\$1,000), and the cell to be varied (pretax cost savings starting in year 2). The result is that constant dollar pretax cost savings of \$142 million are needed starting in year 2 in order to generate NPV of synergies equal to \$1 billion. The resulting analysis is given in Exhibit 11.7. An analysis like this is easily replicated for asset reductions, revenue enhancements, and WACC reductions.

Knowing that he or she must generate constant dollar pretax savings of \$142 million in order to justify the deal, the executive can research possible sources, and interview the operating managers about the likelihood of attaining those savings. This kind of research must be conducted carefully, as CEOs might simply be told the answers they want to hear. Furthermore, if the entire organization is in the grip of deal frenzy, there may be a tendency to bless any synergy assumptions simply to consummate the deal. In short, backsolving with the aid of a computer appears to be rigorous, but is no guarantee of rationality. As argued repeatedly in this volume, discipline is an indispensable virtue.

SYNERGIES IN THE DAIMLER/CHRYSLER MERGER

In the spring of 1998, the CEOs of Chrysler Corporation and Daimler-Benz A.G. sought to structure the terms of merger. More details of this situation are given in Chapter 9 (“Valuing Firms”). The executives rationalized the merger in terms of the economic benefits to be created. Thus, an estimate of the size of these joint gains would be influential, and perhaps decisive, in the shareholders’ conclusions about the deal. How much value would the merger create?

The analysis of synergies should follow this range of steps:

1. **Identify.** Many CEOs will simply set targets for synergies, based on the belief that it will be possible to wring savings out of the two companies in a merger—

EXHIBIT 11.7 Illustration of Backsolving to Find the Required Constant Dollar Pretax Cost Savings in Years 2 and Beyond Necessary to Yield Present Value of Synergies of \$1 Billion

		Year					
		0	1	2	3	4	5
1 Pretax cost savings, constant dollars			\$50	\$142	\$142	\$142	\$142
2 Expected inflation rate			2%	2%	2%	2%	2%
3 Growth rate of FCF (nominal), in perpetuity	2%						
4 Discount rate	6%						
5 Ongoing investment/savings (year 3+)	5%						
6 Pretax cost savings, current dollars			\$51	\$148	\$151	\$154	\$157
7 Tax expense (@ .40)			(20)	(59)	(60)	(62)	(63)
8 After-tax cost savings			31	89	91	92	94
9 Less: investment necessary to realize the savings		\$(1,000)	—	—	(8)	(8)	(8)
10 Plus: disinvestment associated with the savings			20	20	10	—	—
11 Subtotal		(1,000)	51	109	93	85	86
12 Terminal value							2,202
13 Free cash flow		\$(1,000)	\$51	\$109	\$93	\$85	\$2,289
14 Net present value of cost savings		\$1,000					
15 Internal rate of return of synergy investment		23%					

this casual approach to synergy planning is surely the route to disappointment. Instead, analysts should consider carefully where the savings might come from, their timing, and their size. The list of synergy sources given earlier in this chapter affords a framework for identifying the possible range of savings. Exhibit 11.8 gives a hypothetical listing of the synergies the two CEOs considered in the deal between Daimler-Benz and Chrysler.

2. **Scrutinize.** After identifying all possible synergies, one must judge them with cold realism. All synergies are not created equal: Some are more likely than others; some can be realized speedily, others only after great exertion. The step of scrutinizing the potential synergies is essentially the step of thinking like an investor (see Chapter 9). Synergies that are far-fetched or have a complicated story simply will not be credible, and might endanger shareholder approval of the deal. Exhibit 11.8 gives a critique of the hypothesized synergies in the deal.
3. **Value.** The cost savings synergies survived the test of scrutiny. Exhibit 11.9 enters them into the model, "Valuing Synergies.xls," on the CD-ROM.

■ **Base case.** The pretax savings are projected to grow in a straight line from \$1.4 billion to \$3.0 billion from 1999 to 2001, and thereafter to grow at the rate of inflation, about 2.5 percent. The investment necessary to generate this

EXHIBIT 11.8 Identification of Potential Synergies, Merger of Daimler-Benz and Chrysler

Synergy Category	Hypothesized Synergies	Comments upon Scrutiny
Cost savings	Savings in purchasing (from greater power over suppliers) and in new product design and development. As subsequently reported, these savings were expected to amount to \$1.4 billion in 1999 and \$3.0 billion by 2001.	Because the product lines of the two firms did not overlap materially, it seemed unlikely that savings would accrue from consolidating plants or distribution channels. But savings from purchasing and development were fairly credible estimates, compared to the experience from other mergers in the automotive industry. Unclear in the case of this merger would be the size of any outlays necessary to realize these savings.
Asset reductions	Savings from closing redundant offices and plants.	Given the complementary nature of the two firm's automotive businesses, it was unclear what redundancies might be created in the merger. Chrysler's headquarters in Bloomfield Hills, Michigan, might be necessary to house the management of the North American business of the new firm.
Revenue enhancements	Sell more units at higher prices.	Neither sources of enhancement seemed likely in the case of the Daimler/Chrysler merger. The plan of the two CEOs was to preserve the separate brand names and dealership structures for Chrysler and Daimler. Therefore, it seemed unlikely that Chrysler would benefit from a rebranding effect from its association with Mercedes-Benz.
Financing synergies	Reduction of WACC from cross-border combination.	WACC reduction assumed failure of arbitrage between U.S. and Germany, which is not realistic. Anyway, Daimler-Benz was listed on the NYSE for trading.
Real option synergies	The merger might give Chrysler an entrée into Europe, a continent that it had not penetrated as successfully as the other two major American auto firms. Chrysler's Jeep brand and its minivans were appealing to European consumers. Technology transfer was also an important real option benefit.	On the other hand, Europe had serious overcapacity in its automotive industry, and other manufacturers were offering competing models. The benefit of this entry option might not be material. The cultural gulf between the two firms might impede the rate and timing of transfers of know-how.

(Continued)

EXHIBIT 11.8 (Continued)

Synergy Category	Hypothesized Synergies	Comments upon Scrutiny
	Chrysler was a champion at rapid model design and production. Mercedes was known for its production quality and engineering. The option to transfer this firm-specific know-how might create value	

EXHIBIT 11.9 Base-Case Estimate of Synergy Value, Merger of Daimler-Benz and Chrysler (Values in Millions of Dollars, Except for per-Share Amounts)

		Year					
		0 1998	1 1999	2 2000	3 2001	4 2002	5 2003
1	Pretax cost savings, constant dollars		\$1,400	\$2,200	\$3,000	\$3,000	\$3,000
2	Expected inflation rate		2.5%	2.5%	2.5%	2.5%	2.5%
3	Growth rate of FCF (nominal), in perpetuity	2.5%					
4	Discount rate	8.1%					
5	Ongoing investment/savings (year 3+)	2%					
6	Tax rate	38.5%					
7	Pretax cost savings, current dollars		\$1,435	\$2,311	\$3,231	\$3,311	\$3,394
8	Tax expense		(552)	(890)	(1,244)	(1,275)	(1,307)
9	After-tax cost savings		883	1,421	1,987	2,037	2,087
10	Less: investment necessary to realize the savings	\$(1,000)			(65)	(66)	(68)
11	Plus: disinvestment associated with the savings		—	—	—	—	—
12	Subtotal	(1,000)	883	1,421	1,922	1,970	2,020
13	Terminal value						36,965
14	Free cash flow	\$(1,000)	\$883	\$1,421	\$1,922	\$1,970	\$38,985
15	Net present value of cost savings	\$34,986					
16	Internal rate of return of synergy investment	163%					
17	Number of Chrysler Corporation shares	648.4					
18	Value of synergy per Chrysler share	\$53.96					

savings is assumed to be 2 percent. The WACC and tax rate are 8.1 and 38.5 percent respectively, consistent with the discussion in Chapter 9. An initial investment of \$1 billion for tooling, technology transfer, and other costs is also assumed. The base-case estimate of the present value of this stream of cost savings is \$34.9 billion, which translates to \$53.96 per share of Chrysler stock. This is a huge creation of joint value, especially when measured against

the intrinsic value of Chrysler shares, estimated in Chapter 9 as between \$50 and \$65 per share. Remember that the estimate of synergy value is over and above the estimate of intrinsic value of the target firm on a stand-alone basis.

- **Sensitivity analysis.** Perhaps the savings estimate has been irrationally exuberant. Exhibit 11.10 tests the sensitivity of the synergy value to variations in growth rate and investment. Under sensitivity tests, the values of synergy per Chrysler share remain large. Even assuming that the cash flows experience zero growth per year and that the initial outlay to realize these savings is \$1.4 billion, the synergy value per Chrysler share is \$34.46, still sizable compared to Chrysler's intrinsic value.
- **Backsolving analysis.** One can exercise the model in reverse to determine a range of breakeven assumptions necessary to generate acceptable outcomes. For instance, the constant dollar cost savings in the third year and thereafter necessary to generate synergies that will yield only a 15 percent IRR despite a \$1 billion investment is negative. In other words, simply to reach a rate of return that would merely be acceptable in most large industrial corporations would require a dramatic erosion of actual performance from projected, on the order of half.
- **Extensions.** The analyst should anticipate possible extensions of the valuation analysis, which might not be reported in a first-cut assessment. Premier among these would be the effect of a *cyclical downturn* on the synergy benefits. After all, the automotive industry is highly cyclical, and by 1998 the U.S. economy was already in the late stages of an economic expansion. Further modeling work could shed light on synergy values in various economic scenarios, as well as sensitivities and breakevens within those scenarios.
- **Triangulate toward a range of estimates of synergy value.** Many of the assumptions in the base-case estimate are conservative: any growth in the synergy savings is merely at the rate of inflation. Unknown is how liberal are the projections of \$1.4 billion rising to \$3.0 billion in two years. Ideally the analyst would be within, or close to, the merging firms, and be able to gauge the realism of the savings. Lacking inside information, the sheer size of the \$53.96 synergy value per share seems optimistic—this could form the high end of one's triangulation range. A skeptical analyst might favor a scenario of eroding benefits and higher investments, which would be consistent with synergy values of around \$25 per share (from Exhibit 11.10).

EXHIBIT 11.10 Sensitivity Analysis of Synergy Values per Chrysler Share in the Merger of Daimler-Benz and Chrysler (Values in Dollars per Share)

Initial Investment Outlay Necessary to Realize Savings	Growth Rate of Savings			
	-2.5%	0.0%	2.5%	5.0%
\$ —	\$26.69	\$36.62	\$55.50	\$105.01
\$ (250)	\$26.30	\$36.23	\$55.11	\$104.62
\$ (500)	\$25.91	\$35.84	\$54.73	\$104.24
\$(1,000)	\$25.14	\$35.07	\$53.96	\$103.46
\$(1,400)	\$24.53	\$34.46	\$53.34	\$102.85

4. *Prepare implications for deal designers and negotiators.* The main insight from this analysis is that the merger will create significant value; the CEOs of the two firms should develop a communication effort to the shareholders that builds credibility in these savings. Second, synergies of approximately \$25 to \$54 per share are a joint surplus that remains to be divided in structuring a deal. Obviously, Daimler-Benz would not want to pay more for Chrysler than Chrysler's stand-alone value plus value of synergies. Choice of the form of payment can affect how the synergy value gets allocated between the shareholders of Daimler-Benz and Chrysler. Third, the CEOs will need to give careful thought to structuring the postmerger integration plan in order to achieve these savings. It may be necessary to motivate managers with special plans and compensation targeted toward the achievement of these savings.

RULES OF THUMB

One of the most important reasons to exercise caution and discipline in M&A analysis is that there are almost no respectable benchmarks against which to test the reasonableness of synergy assumptions. The problem arises from the uniqueness of companies, and the economic forces in different industries. But in a few industries experiencing a high volume of deals, it is possible to derive some expectations about where synergies should be relatively higher and lower:

- Highest in horizontal deals; middling in vertical combinations; lowest in conglomerate deals. Generally, the work of Rumelt (1986) suggests that returns on investment depend on the strategic relatedness of the buyer and target firms. Unrelated firms will have fewer opportunities for cost savings, revenue enhancements, and the like.
- Highest in *in-market deals*; lower in *market extension deals*.⁹ Rhoades¹⁰ reports that in-market bank mergers show cost savings equal to 30 to 40 percent of the target bank's noninterest expense. Gilson and Escalle¹¹ report research by the Mitchell Madison Group that affords an interesting comparison: The market-extension merger of First Union and First Fidelity banks in 1995 produced synergies of only 5 percent of the target's noninterest expense. This disparity is even sharper in functional areas of banks. For instance, for in-market mergers, the savings are 35 percent for branch networks and 40 percent for staff, systems, and operations. In contrast, for market extension deals, the savings are 5 percent for branch networks and 20 percent for systems and operations.

CONCLUSION: OBJECTIVITY ABOVE ALL ELSE

The examples and discussion in this chapter validate an important insight: "Synergy" can be a fluffy concept; its value implications are easily overblown. Michael Goold and Andrew Campbell wrote, "Most corporate executives, whether or not they have any special insight into synergy opportunities or aptitude for nurturing collaboration, feel they *ought* to be creating synergy. . . . The synergy bias becomes

an obsession for some executives. Desperately seeking synergy, they make unwise decisions and investments.”¹²

The first defense against this is to apply tools of rigorous analysis to gain clarity about the size and variability of synergy values. The second defense is skepticism: in competitive markets it is difficult to win sustained, supernormal rates of return for very long. One must always scrutinize the source of synergy, and ultimately ask why someone else hasn't tried it before, or how long it will be until a competitor imitates the source of synergy. In addition, one must ask, “Does this reputed ‘synergy’ do something for shareholders that they cannot do for themselves?” It was in this spirit of skepticism that Warren Buffett offered the following comment:

*Many managers were apparently over-exposed in impressionable childhood years to the story in which the imprisoned, handsome prince is released from the toad's body by a kiss from the beautiful princess. Consequently they are certain that the managerial kiss will do wonders for the profitability of the target company. Such optimism is essential. Absent that rosy view, why else should the shareholders of company A want to own an interest in B at a takeover cost that is two times the market price they'd pay if they made direct purchases on their own? In other words investors can always buy toads at the going price for toads. If investors instead bankroll princesses who wish to pay double for the right to kiss the toad, those kisses better pack some real dynamite. We've observed many kisses, but very few miracles. Nevertheless, many managerial princesses remain serenely confident about the future potency of their kisses, even after their corporate backyards are knee-deep in unresponsive toads.*¹³

NOTES

1. Sirower (1997), page 5.
2. For more on this case, see Bruner (1983).
3. Myers (1977).
4. Quoted from Houston and Ryngaert (1996), page 76.
5. See Merton and Perold (1993).
6. Interview with Ron Mitsch, January 27, 2000.
7. S-4 Registration Statement filed with the Securities and Exchange Commission, December 2000, by Quaker Oats and PepsiCo, page I-67.
8. Chapter 14 surveys the range of real option valuation methods, most of which are more flexible to the nuances of valuing an R&D program than is the Black-Scholes option pricing model used in the illustration here. Black-Scholes is applied here only for simplicity of illustration.
9. In-market deals combine two firms in the same geographical market. Market-extension deals combine two firms in differing geographical markets.
10. Reported in Rhoades (1998), page 285.
11. See Gilson and Escalle (1998).
12. Quoted from Goold and Campbell (1998), page 132.
13. Quoted from the Chairman's Letter to Shareholders (written by Warren Buffett), Berkshire Hathaway Annual Report, 1981. Copyright © 1981 by Berkshire Hathaway. Reprinted by permission of Warren E. Buffett.