Today's technology can put adjusted present value into the arsenal of every general manager.

Using APV: A Better Tool for Valuing Operations

by Timothy A. Luehrman

If you learned valuation techniques more than a few years ago, chances are you are due for a refresher course. You were certainly taught that the best practice for valuing operating assets – that is, an existing business, factory, product line, or market position – was to use a discounted-cash-flow (DCF) methodology. That is still true. But the particular version of DCF that has been accepted as the standard over the past 20 years – using the weighted-average cost of capital (WACC) as the discount rate – is now obsolete.

True, business schools and textbooks continue to teach the WACC approach. But that's because it's out there as the standard, not because it performs best. Today those same schools and texts also present alternative methodologies. One alternative, called *adjusted present value* (APV), is especially versatile and reliable, and will replace WACC as the DCF methodology of choice among generalists. (See "What's It Worth? A General Manager's Guide to Valuation," in this issue of HBR.)

For managers with businesses to run, the question of which valuation method to use has always come down to a pragmatic comparison of alternatives. What might you use instead of WACC? Just like WACC, APV is designed to value operations, or assets-in-place; that is, any existing asset that will generate future cash flows. This is the most basic and common type of valuation problem that managers face. Why choose APV over WACC? For one reason, APV always works when WACC does, and sometimes when WACC doesn't, because it requires fewer restrictive assumptions. For another, APV is less prone to serious errors than WACC. But most important, general managers will find that APV's power lies in the added managerially relevant information it can provide. APV can help managers analyze not only how much an asset is worth but also where the value comes from.

All discounted-cash-flow methodologies involve forecasting future cash flows and then discounting them to their present value at a rate that reflects their riskiness. But the methodologies differ in the details of their execution, most particularly in how they account for the value created or destroyed by financial maneuvers, as opposed to operations. APV's approach is to analyze financial maneuvers separately and then add their value to that of the business. (See the exhibit "APV: The Fundamental Idea.") WACC's approach is to adjust the discount rate (the cost of capital) to reflect financial enhancements. Analysts apply the adjusted discount rate directly to the business cash flows; WACC is supposed to handle financial side effects automatically, without requiring any addition after the fact.

In reality, WACC has never been that good at handling financial side effects. In its most common formulations, it addresses tax effects only – and not very convincingly, except for simple capital structures. However, its compelling virtue is that it requires only one discounting opera-

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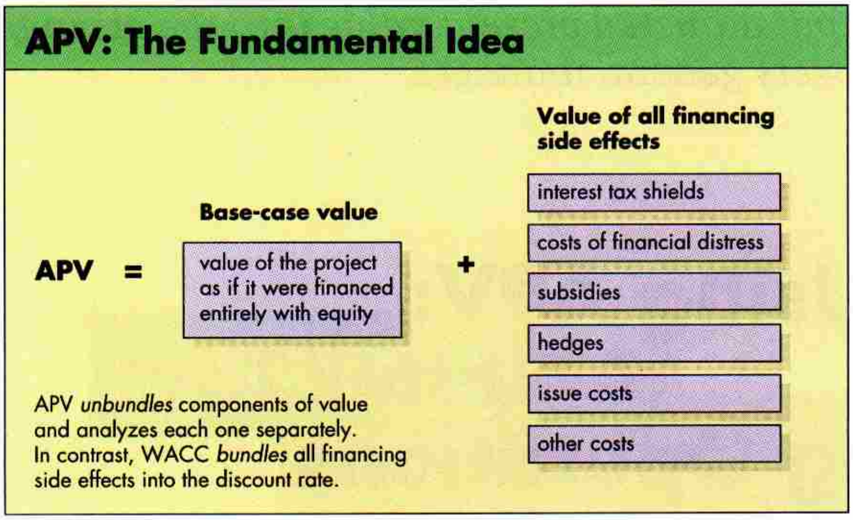
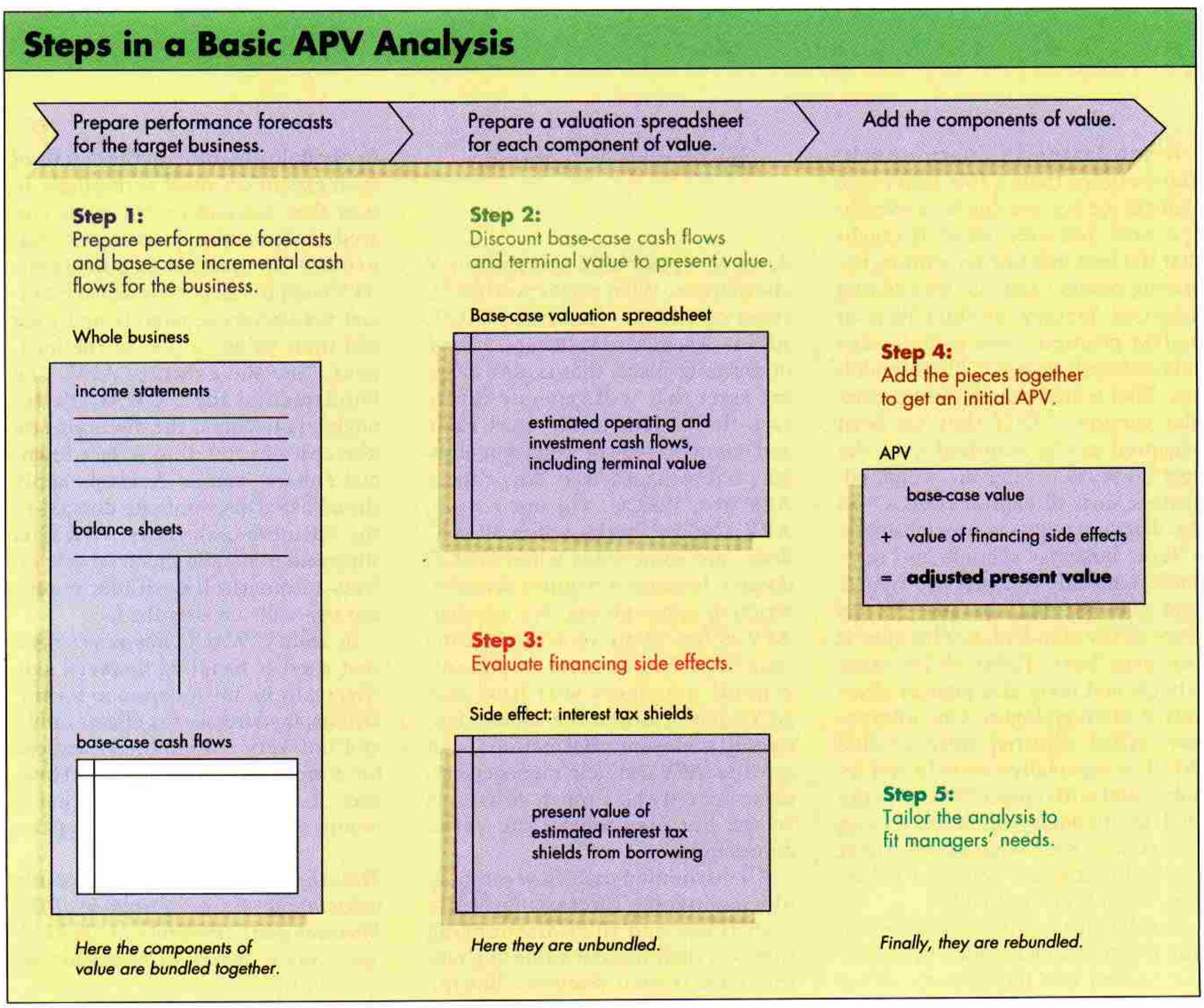


tion, a boon in the past to users of calculators and slide rules. Today that advantage is irrelevant. High-speed spreadsheets make light work of the extra discounting required by APV. More than 20 years after APV was first proposed, its unbundling of the components of value, always very informative, is now also very inexpensive.

APV is flexible. A skilled analyst can configure a valuation in whatever way makes most sense for the people involved in managing its separate parts. The basic framework can be highly refined or customized according to tastes and circumstances, but a simple example illustrates the essential idea.

An APV Case Study

Roy Henry, president of IBEX Industries, has his eye on an acquisition target: Acme Filters, a division of SL Corporation. Acme is a mature business that has underperformed in its industry for the past six years. After an internal campaign to boost performance fell short of senior executives' expectations, SL Corpora-



tion resolved to sell Acme. Working with division managers from IBEX Industries who know Acme's operations and with some external professionals, Henry has targeted the following specific opportunities for value creation:

□ Acme's product line will be rationalized, and some components will be outsourced to improve the company's operating margin by three percentage points.

□ The same changes will reduce inventory and boost payables, producing onetime reductions in net working capital.

□ Some of Acme's nonproductive assets will be sold.

□ Distribution will be streamlined and new sales incentives introduced to raise Acme's sales growth from 2% to 3% annually to the industry average of 5%.

□ Some taxes will be saved, mostly through the interest tax shields associated with borrowing.

The seller's representatives have indicated that SL Corporation is reluctant to accept less than book value (currently $307 million) for Acme, despite the division's recent lackluster performance. Henry's financial experts believe that a deal at book value could be financed with about 80% debt, comprising senior bank debt, privately placed subordinated debt, and a revolving credit facility. (See the pro forma balance sheets in the table "Step 1: Prepare Performance Forecasts.") Henry expects to pay down that debt as quickly as possible (and the lenders will insist on it) and to arrive at a debt-to-capital ratio no higher than 50% within five years. He will try to hold fees down to $15 million, but they could well reach as high as $20 million or more.

Acme does not have publicly traded shares, but a few similar companies do, and they provide benchmarks for estimating the cost of equity. One such company, with a historical debt ratio of 45% to 50%, has an estimated cost of equity of 24%. Another, with no debt in its capital structure, has an estimated cost of equity of 13.5%. In general, Henry's equity investors expect significantly higher returns – of 30% to 35%. For comparison, let us suppose that the return on long-term government bonds is 5%.

Step 1: Prepare Performance Forecasts

(in millions of dollars)

Pro Forma Income Statements

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
EBIT		$22.7	29.8	37.1	40.1	42.1
Interest		21.6	19.1	17.8	16.7	15.8
EBT		1.1	10.7	19.3	23.3	26.3
Taxes @ 34%		0.4	3.6	6.6	7.9	8.9
Net income		0.7	7.1	12.7	15.4	17.3
Supplemental data						
Depreciation		$21.5	13.5	11.5	12.1	12.7
Capital expenditures		10.7	10.1	10.4	11.5	13.1
Δ Net working capital		−12.3	1.9	4.2	5.2	6.1
Δ Other assets		9.0	6.9	3.4	0.0	0.0

Pro Forma Balance Sheets

Assets	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Net working capital	$60.0	47.7	49.6	53.7	59.0	65.1
Net fixed assets	221.0	210.3	206.9	205.7	205.1	205.5
Other assets	26.0	17.0	10.1	6.7	6.7	6.7
Total assets	307.0	275.0	266.5	266.2	270.8	277.3
Liabilities and equity						
Revolver @ 7.5%	$13.0	0.2	4.8	11.7	20.9	20.0
Bank loan @ 8.0%	80.0	60.0	40.0	20.0	0.0	0.0
Subordinated debt @ 9.5%	150.0	150.0	150.0	150.0	150.0	0.0
Long-term debentures at 9.0%	0.0	0.0	0.0	0.0	0.0	140.0
Total debt	243.0	210.2	194.8	181.7	170.9	160.0
Equity	64.0	64.7	71.8	84.5	99.9	117.2
Total liabilities and equity	307.0	275.0	266.5	266.2	270.8	277.3
Supplemental data						
Interest paid	$0.0	21.6	19.1	17.8	16.7	15.8
Principal repaid	0.0	32.8	15.5	13.1	10.8	10.9
Dividends	0.0	0.0	0.0	0.0	0.0	0.0

Base-Case Cash Flows

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
EBIT		$22.7	29.8	37.1	40.1	42.1
– Taxes @ 34%		7.7	10.1	12.6	13.6	14.3
= EBIT (1 – t)		15.0	19.6	24.5	26.4	27.8
+ Depreciation		21.5	13.5	11.5	12.1	12.7
= Operating cash flow		36.5	33.1	36.0	38.5	40.4
– Δ Net working capital		12.3	−1.9	−4.2	−5.2	−6.1
– Capital expenditures		−10.7	−10.1	−10.4	−11.5	−13.1
– Δ Other assets		9.0	6.9	3.4	0.0	0.0
= Free cash flow of assets		47.0	28.1	24.8	21.8	21.3

Executing an APV Analysis

Now let's estimate the APV of this acquisition target. The first task is to evaluate the business as if it were financed entirely with equity. Then, because it will not be financed entirely with equity, we add or subtract value associated with the financing program that we expect to utilize. (See the exhibit "Steps in a Basic APV Analysis.") Presumably, the net effect of the program will be positive; otherwise, we would use only equity financing.

Step 2: Discount Base-Case Cash Flows and Terminal Value to Present Value

(in millions of dollars)

Base-Case Value

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Free cash flow of assets		$47.0	28.1	24.8	21.8	21.3
Terminal value of assets						263.4
Discount factor @ 13.5%	1.0000	0.8811	0.7763	0.6839	0.6026	0.5309
Present value, each year		$41.4	21.8	17.0	13.1	151.1
Base-case value (total)	**$244.5**					

To determine the value of Acme Filters using APV, carry out the following five steps:

Step 1: Lay out the base-case cash flows. The base-case value is built on financial projections that would be prepared for *any* DCF approach to this problem, including the WACC-based valuation most companies already use. The projections consist of expected incremental operating and investment cash flows for the target business. For Acme's figures, see the table "Step 1: Prepare Performance Forecasts." (To save space, we have omitted the above-the-line items that go into the EBIT forecast.) In the first year, for example, Henry expects after-tax operating cash flow to be $36.5 million. The chart shows a reduction (a net inflow) of net working capital in the first year as he liquidates inventory and increases payables, followed by new investment (a net outflow) to support subsequent growth in sales. Capital expenditures represent another cash outflow. Finally, the change in other assets picks up after-tax cash proceeds from liquidating the nonproductive assets mentioned above. The operating cash flow, plus or minus those investment effects, gives "free cash flow of assets."

Step 2: Discount the flows using an appropriate discount rate and terminal value. As with any DCF valuation, we need a discount rate and a terminal value. How these items are treated is where APV begins to diverge from other methods. Start with the discount rate. We want an opportunity cost of capital; that is, the return Henry's investors could expect to earn by investing in some other asset with the same riskiness that the target assets would exhibit if they were financed entirely with equity. Our best benchmark for this opportunity cost is 13.5% – the cost of equity for a comparable company with an all-equity capital structure.

The last ingredient is a terminal value for the assets. This is simply the estimate, at some terminal horizon, of the assets' value, taking into account everything after the terminal horizon. For a going concern, we usually choose as the terminal horizon the earliest point after which we can regard the assets as a perpetuity or some other simple financial construct. Suppose we expect free cash flow for years six and after to grow at 5% per year in perpetuity. The value (at the end of year five) of such a perpetuity is simply the year-six cash flow divided by the result of the discount rate minus the growth rate $(0.135 - 0.05 = 0.085)$, which equals $263.4 million.

Now we discount the free cash flows and the terminal value at 13.5%, as shown in the chart, to obtain a base-case value of $244.5 million. Note that this figure is lower than the book value sought by the hopeful seller.

Step 3: Evaluate Financing Side Effects

(in millions of dollars)

Interest Tax Shields

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Interest tax shield		$7.4	6.5	6.1	5.6	5.4
Terminal value of tax shields						122.4
Discount factor @ 9.5%	1.0000	0.9132	0.8340	0.7617	0.6956	0.6352
Present value, each year		$6.7	5.4	4.6	3.9	81.2
Total present value, tax shields	**$101.8**					

Step 3: Evaluate the financing side effects. Of the several possible side effects of Henry's proposed financing program, we will examine only one here: interest tax shields. Interest tax shields arise because of the deductibility of interest payments on the corporate tax return (versus the nondeductibility of dividends). Why is this a side effect? Because the projected tax payments in the base case are too high – the hypothetical all-equity-financed company pays no interest and receives no tax deduction. With the capital structure Henry is contemplating, the interest deduction will reduce taxable income by the amount of the interest

Step 4: Add the Pieces Together to Get an Initial APV

(in millions of dollars)

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Base-case value	$244.5					
Side effect: tax shields	$101.8					
Adjusted present value	**$346.3**					

Step 5: Tailor the Analysis to Fit Managers' Needs

(in millions of dollars)

Baseline Performance

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
EBIT baseline		$20.4	26.8	33.4	36.1	37.9
– Taxes @ 34%		7.0	9.1	11.4	12.3	12.9
= EBIT (1 – t)		13.5	17.7	22.0	23.8	25.0
+ Depreciation		21.5	13.5	11.5	12.1	12.7
= Operating cash flow		35.0	31.1	33.5	35.9	37.7
– Δ Net Working Capital		–4.0	–4.0	–4.2	–5.2	–6.1
– Capital expenditures		–10.7	–10.1	–10.4	–11.5	–13.1
= Free cash flow, baseline		20.2	17.0	19.0	19.2	18.5
Terminal value, baseline						172.8
Discount factor @ 13.5%	1.0000	0.8811	0.7763	0.6839	0.6026	0.5309
Present value, each year		$17.8	13.2	13.0	11.5	101.6
Baseline business value	**$157.2**					

Increments: Value-Creation Initiatives

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
1. Margin improvement						
Incremental EBIT		$2.3	3.0	3.7	4.0	4.2
– Taxes @ 34%		0.8	1.0	1.3	1.4	1.4
= Cash increment		1.5	2.0	2.4	2.6	2.8
Increment to terminal value						25.9
Present value, each year (@ 13.5%)		1.3	1.5	1.7	1.6	15.2
Value of margin improvement	**$21.3**					
2. Net-working-capital improvement						
Incremental cash flow		$16.3	2.1			
Present value, each year (@ 13.5%)		14.4	1.7			
Value of net-working-capital improvement	**$16.0**					
3. Asset sales						
Incremental cash flow		$9.0	6.9	3.4		
Present value, each year (@ 13.5%)		7.9	5.4	2.3		
Value of asset sales	**$15.6**					
4. Higher steady-state growth						
Incremental terminal value						$64.7
Value of higher growth	**$34.3**					

Sum of baseline and increments	**$244.5**	
+ Value of interest tax shields	$101.8	(as before)
= Adjusted Present Value	$346.3	(as before)

and so will reduce the tax bill by the amount of interest times the tax rate. In the first year, the interest tax shield is $7.4 million ($21.6 million × 0.34). In the second year, it is $6.5 million, and so forth, as shown.

As with the base case, we still need a terminal value and a discount rate. Academics agree that tax shields, like any other future cash flow, should be discounted at an "appropriate" risk-adjusted rate – that is, a rate that reflects riskiness. Unfortunately, they don't agree on how risky tax shields are. A common expedient is to use the cost of debt as a discount rate, on the theory that tax shields are about as uncertain as principal and interest payments. Of course, there may come a time when you can afford to make your interest payments but can't use the tax shields. This suggests that tax shields are a bit more uncertain and so deserve a somewhat higher discount rate. Others argue for an even higher discount rate, observing that managers will adjust leverage up or down according to prevailing business conditions or the fortunes of the company. If so, then future interest payments, along with the tax shields, will fluctuate for the same reasons that operating cash flows fluctuate and therefore deserve the same discount rate. Following the most common approach, we used a rate of 9.5% – a figure a bit higher than the average cost of debt and thus on the high side of the lower end of the range just described.

For a terminal value, suppose first that at the end of year five the company refinances its outstanding debt with a new $140 million issue of long-term debentures at 9%. In subsequent years, indebtedness grows as the company grows – say, at 5%. So, too, will interest tax shields grow. In year five, the value of this perpetually growing stream of tax shields is $122 million. Discounting all the tax shields back to the present gives a value for this side effect of $101.8 million.

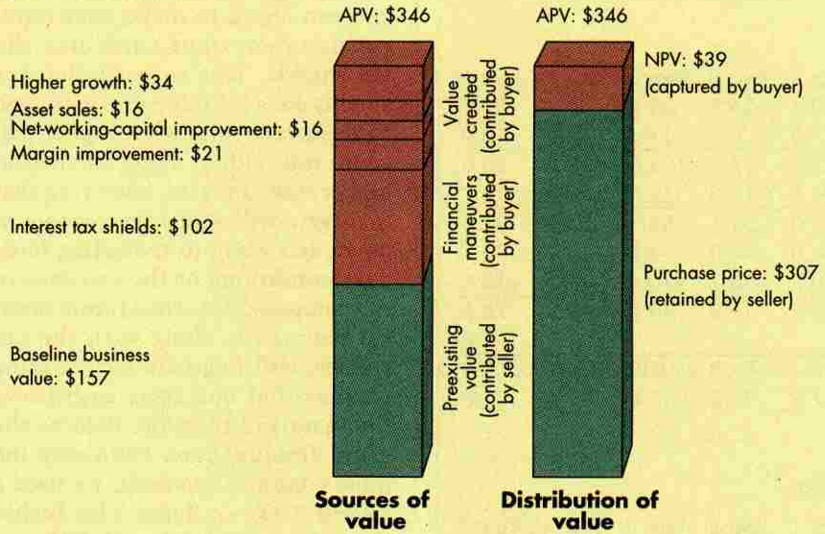
Step 4: Add the pieces together to get an initial APV. By adding the base-case value and the value of the interest tax shields, we get an initial estimate of the target's APV:

APV = $244.5 million (base-case value) + $101.8 million (value of side effects) = $346.3 million.

We say this is an initial estimate for two reasons. First, we have ignored other financing side effects here to shorten the presentation. And second, even within this simplified example, we can push the APV analysis further and obtain more insight. So far, our analysis suggests that buying this business for $307 million is a good deal: Henry would increase his investors' wealth by the net present value of the acqui-

APV Is Rich in Information

(in millions of dollars)



Although the buyer is creating $87 million – and still more in tax savings – all but $39 million is paid to the seller.

sition, or about $39 million. (NPV = $346.3 million – $307 million).

Step 5: Tailor the analysis to fit managers' needs. How much of Acme's value is already there, and how much is Henry creating by assuming ownership and implementing changes? How much value does each of his planned initiatives create? Do the executives responsible for realizing that value know how much it is? Do they know what it depends on? Finally, how much of the value that is to be created will be paid over to the seller at closing? The fifth step of an APV analysis can examine these and other managerially pertinent questions.

Start by unbundling the base-case cash-flow projections into separate cash flows associated with Henry's value-creation initiatives. In the table "Step 5: Tailor the Analysis to Fit Managers' Needs," the base-case free cash flows are decomposed. Baseline cash flows are derived from recent operating results and represent the business in its current underperforming configuration. Then there are increments for each of the proposed initiatives: margin improvements; net-working-capital improvements; asset liquidations; and higher steady-state growth. When each of these is taxed and discounted, we see that the baseline business is worth $157 million and that operating improvements would add $87 million. (Both figures exclude interest tax shields.) About a third of the $87 million comes from short-term initiatives: selling unproductive assets and reducing working capital. The rest comes from ongoing initiatives: improving margins and boosting growth. Most likely, those four tasks will be in the hands of different people. It's crucial that they do their jobs well, because even though $87 million of value will be created, only $39 million (the NPV) will be retained by the new owners. The rest will go to the seller as part of the sale price.

We could push the analysis still further in several ways, depending on what would help managers, negotiators, or financiers. We could examine different scenarios for each category. We could reassess tax shields to look at different proposed deal structures or to allocate debt capacity to the different parts of the business or specific initiatives. We could reassess risk, perhaps adjusting the discount rates in the subpart valuations. Suppose, for example, that working capital improvements came primarily from liquidating excess raw-materials inventories; the associated cash flow would likely contain less business risk than normal operating cash flows and so would deserve a discount rate somewhat lower than 13.5%. Alternatively, suppose the margin improvements came from increased automation and, hence, higher fixed costs; this would suggest that those incremental cash flows deserve a somewhat higher discount rate.

Could these extra analytical features be performed with WACC? Maybe, but first we'd have to get the WACC computed correctly. (See the insert "The Pitfalls of Using WACC.") Then if we wanted to consider that different cash flows may have different risk characteristics and so deserve different discount rates, we'd have to compute the WACC for all the different value-creation initiatives. That would force us to think about the capital structure of, say, net-working-capital improvements. And have we expressed the debt ratio for that structure in market-value or book-value terms? Does the ratio change over time? The exercise is even more prone to error than the simple formulation in the insert. APV is both less cumbersome and more informative.

APV is exceptionally transparent: you get to see all the components of value in the analysis. None are buried.

APV's signature characteristic is that no discount rate contains anything other than time value (the risk-free rate of interest) and a risk premium (according to the riskiness of the cash flows being discounted). Any value created by financial maneuvers – tax savings, risk management, subsidized debt, credit-enhanced debt – has its own cash-flow

The Pitfalls of Using WACC

We can evaluate Acme Filters without APV, using the same pro forma cash-flow projections and discounting at the weighted-average cost of capital (WACC). Unfortunately, this is not as simple a procedure as textbooks often make it appear. A sketch of the approach many companies take to this analysis highlights some of its pitfalls.

In a WACC-based analysis, we discount only once – the discount rate has to be adjusted to pick up all the costs and benefits of a selected capital structure. Not surprisingly, a lot of analytical energy goes into computing it. WACC is just what it says it is: a weighted average of the after-tax costs of different sources of capital, in which each is weighted by the fraction of the capital structure it represents. In our example, there are three kinds of debt (four if you consider the refinancing in year five) and one kind of equity. See the calculations in the table above to observe how we obtained a WACC of 9.7%.

(in millions of dollars)

WACC Calculations

Source of funds	Amount	Percentage of funds	After-tax cost	Weighted cost
Debt:				
Revolving credit @ 7.5%	$13	4.2%	0.050	0.2%
Bank debt @ 8.0%	80	26.1%	0.053	1.4%
Subordinated debt @ 9.5%	150	48.9%	0.063	3.1%
Equity	64	20.8%	0.240	5.0%
Total funds	307	100.0%		**9.7% = WACC**

Discounting Free Cash Flows at WACC

	Year 0	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*
Free cash flow of assets		$47.0	28.1	24.8	21.8	21.3
Terminal value of assets						481.2
Discount factor (WACC)		0.9120	0.8317	0.7585	0.6917	0.6308
Present value, each year		$42.9	23.3	18.8	15.1	317.0
Asset value (total)	**$417.1**					

When we discount the free cash flows from this business at 9.7%, we obtain a value for the business of $417 million, which implies an NPV of about $110 million (NPV = $417 million – $307 million). That is 275% of the figure we got using APV, which itself was probably an overestimate. Obviously, if Henry got into an auction for this business and bid the price up to $417 million, he would transfer a lot of value from his investors to the seller's shareholders.

Why the difference in estimated values? There are several reasons, but the most important is that we made some common errors and miscalculated the WACC. Let's start with the cost of equity, which we assumed to be 24%. One of our benchmarks for the cost of equity was another company in the same business, with about 50% debt in its capital structure. That company's cost of equity is 24%. Since we are aiming for the same amount of leverage, 24% seems a reasonable estimate. But we won't arrive at that capital structure until year five, and in the meantime our leverage is substantially higher. In fact, our debt ratio at closing will be about 80%, which suggests a cost of equity of about 40%, not 24%. But even this figure can't be used alone, because the cost of equity changes every time the debt ratio changes – every year. For the same reason, simply plugging in 30% or 35%, the benchmarks associated with Henry's investors, is also misleading. In short, none of the raw benchmarks Henry has are suitable for WACC.

Another problem is that we used book values to generate the weights in the WACC, whereas the procedure is valid only with market values. To illustrate, suppose for a moment that the value of the business at closing really was $417 million. That implies a *market-value* debt ratio at closing of 58%, not 80% or 50%. And this, too, is subject to change every year. Of course, if we knew the true market value of the assets, we wouldn't need to do the analysis in the first place. One expedient is to guess at the market value or use book values and then iterate – fill in the computed market value as the new guess, then recompute another guess, and so forth until the guess and the computed values converge.

There are other difficulties as well. In fact, every element of WACC presents computational challenges in all but the simplest, most sterile of settings. Can those problems be addressed? For the most part, yes, though demonstrating that is not the point of this article. Suffice it to say that making the indicated adjustments to the simpleminded (but very common) calculation shown here is at least as difficult as – and less informative than – using APV.

consequences. You treat those consequences by laying out the cash flows in a spreadsheet and discounting them at a rate that reflects time value and *their* riskiness, but nothing else. In other words, APV is exceptionally transparent: you get to see all the components of value in the analysis; none are buried in adjustments to the discount rate.

APV has its limitations, of course. Some amount to technicalities, which are much more interesting to academics than to managers. But two in particular are worth knowing about because they introduce consistent biases in the analysis. First, income from stocks – as opposed to bonds – may be taxed differently when the investor files a personal tax return. This usually causes an analyst to overestimate the net advantage associated with corporate borrowing when computing the present value of interest tax shields. And second, most analysts neglect costs of financial distress associated with corporate leverage, and they may ignore other interesting financial side effects as well. More generally, we should bear in mind that for all its versatility, APV remains a DCF methodology and is poorly suited to valuing projects that are essentially options. The most common formulations of WACC suffer from all these limitations and more.

What should you do to learn APV? The good news is, if you've gotten this far, you've already learned it. The basic idea really is that simple. There are indeed fancier formulations that examine, for example, additional side effects, such as financial guarantees or subsidies. And I have glossed over important concepts that help you to select or create sensible discount rates, for example, and to reconcile different benchmarks for the cost of equity. The relevant concepts are well covered in basic corporate-finance texts. For a glimpse of fancier formulations, look at books devoted to fancier problems; the classic example is cross-border valuation, for which APV is enormously helpful. Beyond that, all you need is practice.

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