Best Practices in Estimating the Cost of Capital: Survey and Synthesis

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This paper presents the results of a cost-of-capital survey of 27 highly regarded corporations, ten leading financial advisers, and seven best selling textbooks and trade books. The results show close alignment among all these groups on the use of common theoretical frameworks and on many aspects of estimation. We find large variation, however, for the joint choices of the risk-free rate, beta, and the equity market risk premium, as well as for the adjustment of capital costs for specific investment risk. On these issues, we summarize arguments for different approaches and review responses in detail to glean tradeoffs faced by practitioners. [JEL: G12, G20, G31]

■ In recent decades, theoretical breakthroughs in such areas as portfolio diversification, market efficiency, and asset pricing have converged into compelling recommendations about the cost of capital to a corporation. By the early 1990s, a consensus had emerged prompting such descriptions as "traditional...textbook...appropriate," "theoretically correct," and "a useful rule of thumb and a good vehicle."[1] Beneath this general agreement about cost-of-capital theory lies considerable ambiguity and confusion over how the theory can best be applied. The issues at stake are sufficiently important that differing choices on a few key elements can lead to wide disparities in estimated capital cost. The cost of capital is central to modern finance touching on investment and divestment decisions, measures of economic profit, performance appraisal, and incentive systems. Each year in the US, corporations undertake more than $500 billion in capital spending. Since a difference of a few percent in capital costs can mean a swing in billions of expenditures, how firms estimate the cost is no trivial matter.

The purpose of this paper is to present evidence on how some of the most financially sophisticated companies and financial advisers estimate capital costs. This evidence is valuable in several respects. First, it identifies the most important ambiguities in the application of cost-of-capital theory, setting the stage for productive debate and research on their resolution. Second, it helps interested companies benchmark their cost-of-capital estimation practices against best-practice peers. Third, the evidence sheds light on the accuracy with which capital costs can be reasonably estimated, enabling executives to use the estimates more wisely in their decision-making. Fourth, it enables teachers to answer the inevitable question, "How do companies really estimate their cost of capital?"

The paper is part of a lengthy tradition of surveys of industry practice. Among the more relevant predecessors, Gitman and Forrester (1977) explored "the level of sophistication in capital budgeting techniques" among 103 large, rapidly growing businesses, finding that the internal rate of return and the payback period were in common use. Although the authors inquired about the level of the firm's discount rate, they did not ask how the rate was determined. Gitman and Mercurio (1982) surveyed 177 Fortune 1000 firms about "current practice in cost of capital measurement and utilization," concluding that

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The authors thank Todd Brotherson for excellent research assistance, and gratefully acknowledge the financial support of Coopers & Lybrand and the University of Virginia Darden School Foundation. The research would not have been possible without the cooperation of the 37 companies surveyed. These contributions notwithstanding, any errors remain the authors'.

[1] These sets of quotes come in order from Ehrhardt (1994), Copeland, Koller, and Murrin (1990), and Brealey and Myers (1993).

"the respondents' actions do not reflect the application of current financial theory." Moore and Reichert (1983) surveyed 298 Fortune 500 firms on the use of a broad array of financial techniques, concluding among other things, that 86% of firms surveyed use time-adjusted capital budgeting techniques. Bierman (1993) surveyed 74 Fortune 100 companies reporting that all use some form of discounting in their capital budgeting, and 93% use a weighted-average cost of capital. In a broad-ranging survey of 84 Fortune 500 large firms and Forbes 200 best small companies, Trahan and Gitman (1995) report that 30% of respondents use the capital-asset pricing model (CAPM).

This paper differs from its predecessors in several important respects. Existing published evidence is based on written, closed-end surveys sent to a large sample of firms, often covering a wide array of topics, and commonly using multiple-choice or fill-in-the-blank questions. Such an approach often yields response rates as low as 20% and provides no opportunity to explore subtleties of the topic. Instead, we report the result of a telephone survey of a carefully chosen group of leading corporations and financial advisers. Another important difference is that the intent of existing papers is most often to learn how well accepted modern financial techniques are among practitioners, while we are interested in those areas of cost-of-capital estimation where finance theory is silent or ambiguous, and practitioners are left to their own devices.

The following section gives a brief overview of the weighted-average cost of capital. The research approach and sample selection are discussed in Section II. Section III reports the general survey results. Key points of disparity are reviewed in Section IV. Section V discusses further survey results on risk adjustment to a baseline cost of capital, and Section VI offers conclusions and implications for the financial practitioner.

I. The Weighted-Average Cost of Capital

A key insight from finance theory is that any use of capital imposes an opportunity cost on investors; namely, funds are diverted from earning a return on the next best equal-risk investment. Since investors have access to a host of financial market opportunities, corporate uses of capital must be benchmarked against these capital market alternatives. The cost of capital provides this benchmark. Unless a firm can earn in excess of its cost of capital, it will not create economic profit or value for investors.

A standard means of expressing a company's cost of capital is the weighted-average of the cost of individual sources of capital employed. In symbols, a company's weighted-average cost of capital (or WACC) is

$$WACC = (W_{debt}(1-t)K_{debt}) + (W_{preferred}K_{preferred}) + (W_{equity}K_{equity}) \quad (1)$$

where

K = component cost of capital
W = weight of each component as percent of total capital
t = marginal corporate tax rate

For simplicity, this formula includes only three sources of capital; it can be easily expanded to include other sources as well.

Finance theory offers several important observations when estimating a company's WACC. First, the capital costs appearing in the equation should be current costs reflecting current financial market conditions, not historical, sunk costs. In essence, the costs should equal the investors' anticipated internal rate of return on future cash flows associated with each form of capital. Second, the weights appearing in the equation should be market weights, not historical weights based on often arbitrary, out-of-date book values. Third, the cost of debt should be after corporate tax, reflecting the benefits of the tax deductibility of interest.

Despite the guidance provided by finance theory, use of the weighted-average expression to estimate a company's cost of capital still confronts the practitioner with a number of difficult choices.[2] As our survey results demonstrate, the most nettlesome component of WACC estimation is the cost of equity capital; for unlike readily available yields in bond markets, no observable counterpart exists for equities. This forces practitioners to rely on more abstract and indirect methods to estimate the cost of equity capital.

II. Sample Selection

This paper describes the results of a telephone survey of leading practitioners. Believing that the complexity of the subject does not lend itself to a written questionnaire, we wanted to solicit an explanation of each firm's approach told in the practitioner's own words. Though our interviews were guided by a series of questions, these were sufficiently open-ended to

[2]Even at the theoretical level, Dixit and Pindyck (1994) point out that the use of standard net-present-value (NPV) decision rules (with, for instance, WACC as a discount rate) does not capture the option value of being able to delay an irreversible investment expenditure. As a result, a firm may find it better to delay an investment even if the current NPV is positive. Our survey does not explore the ways firms deal with this issue, rather, we focus on measuring capital costs.

reveal many subtle differences in practice.

Since our focus is on the gaps between theory and application rather than on average or typical practice, we aimed to sample practitioners who were leaders in the field. We began by searching for a sample of corporations (rather than investors or financial advisers) in the belief that they had ample motivation to compute WACC carefully and to resolve many of the estimation issues themselves. Several publications offer lists of firms that are well-regarded in finance;[3] of these, we chose a research report, *Creating World-Class Financial Management: Strategies of 50 Leading Companies* (1992), which identified firms

> selected by their peers as being among those with the best financial management. Firms were chosen for excellence in strategic financial risk management, tax and accounting, performance evaluation and other areas of financial management . . . The companies included were those that were mentioned the greatest number of times by their peers.[4]

From the 50 companies identified in this report, we eliminated 18 headquartered outside North America.[5] Of those remaining, five declined to be interviewed, leaving a sample of 27 firms. The companies included in the sample are contained in Exhibit 1. We approached the most senior financial officer first with a letter explaining our research, and then with a telephone call. Our request was to interview the individual in charge of estimating the firm's WACC. We promised our interviewees that, in preparing a report on our findings, we would not identify the practices of any particular company by name—we have respected this promise in our presentation.

In the interest of assessing the practices of the broader community of finance practitioners, we surveyed two other samples:

- **Financial Advisers.** Using a "league table" of merger and acquisition advisers presented in *Institutional Investor* issues of April 1995, 1994, and 1993, we drew a sample of 10 of the most active[6] advisers. We applied approximately[7] the same set of questions to representatives of these firms' mergers and acquisitions departments. We wondered whether the financial advisers' interest in promoting deals might lead them to lower WACC estimates than those estimated by operating companies. This proved not to be the case. If anything, the estimating techniques most often used by financial advisers yield higher, not lower, capital cost estimates.

- **Textbooks and Tradebooks.** From a leading textbook publisher, we obtained a list of the graduate-level textbooks in corporate finance having the greatest unit sales in 1994. From these, we selected the top four. In addition, we drew on three tradebooks that discuss the estimation of WACC in detail.

Names of advisers and books included in these two samples are shown in Exhibit 1.

III. Survey Findings

The detailed survey results appear in Exhibit 2. The estimation approaches are broadly similar across the three samples in several dimensions.

- Discounted Cash Flow (DCF) is the dominant investment-evaluation technique.
- WACC is the dominant discount rate used in DCF analyses.
- Weights are based on *market* not book value mixes of debt and equity.[8]
- The after-tax cost of debt is predominantly based on *marginal* pretax costs, and *marginal or statutory* tax rates.
- The CAPM is the dominant model for estimating the cost of equity. Some firms mentioned other multi-factor asset-pricing models (e.g., Arbitrage Pricing Theory) but these were in the small minority.

[3]For instance, *Institutional Investor* and *Euromoney* publish lists of firms with the best CFOs or with special competencies in certain areas. We elected not to use these lists because special competencies might not indicate a generally excellent finance department, nor might a stellar CFO.

[4]This survey was based upon a written questionnaire sent to CEOs, CFOs, controllers, and treasurers and was followed up by a telephone survey (Business International Corporation, 1992).

[5]Our reasons for excluding these firms were the increased difficulty of obtaining interviews, and possible difficulties in obtaining capital market information (such as betas and equity market premiums) that might preclude using American practices. The enlargement of this survey to firms from other countries is a subject worthy of future study.

[6]Activity in this case was defined as four-year aggregate deal volume in mergers and acquisitions. The sample was drawn from the top 12 advisers, using their *average* deal volume over the 1993-95 period. Of these 12, two firms chose not to participate in the survey.

[7]Specific questions differ, reflecting the facts that financial advisers infrequently deal with capital budgeting matters and that corporate financial officers infrequently value companies.

[8]The choice between target and actual proportions is not a simple one. Because debt and equity costs clearly depend on the proportions of each employed, it might appear that the actual proportions must be used. However, if the firm's target weights are publicly known, and if investors expect the firm soon to move to these weights, then observed costs of debt and equity may anticipate the target capital structure.

Exhibit 1. Three Survey Samples

Company Sample	Adviser Sample	Textbook/Tradebook Sample
Advanced Micro	CS First Boston	*Textbooks*
Allergan	Dillon, Read	Brealey and Myers
Black & Decker	Donaldson, Lufkin, Jenrette	Brigham and Gapenski
Cellular One	J.P. Morgan	Gitman
Chevron	Lehman Brothers	Ross, Westerfield, and Jaffe
Colgate-Palmolive	Merrill Lynch	*Tradebooks*
Comdisco	Morgan Stanley	Copeland, Koller, and Murrin
Compaq	Salomon Brothers	Ehrhardt
Eastman Kodak	Smith Barney	Ibbotson Associates
Gillette	Wasserstein Perella	
Guardian Industries		
Henkel		
Hewlett-Packard		
Kanthal		
Lawson Mardon		
McDonald's		
Merck		
Monsanto		
PepsiCo		
Quaker Oats		
Schering-Plough		
Tandem		
Union Carbide		
US West		
Walt Disney		
Weyerhauser		
Whirlpool		

No firms cited specific modifications of the CAPM to adjust for any empirical shortcomings of the model in explaining past returns.[9]

These practices differ sharply from those reported in earlier surveys.[10] First, the best-practice firms show much more alignment on most elements of practice. Second, they base their practice on financial economic models rather than on rules of thumb or arbitrary decision rules.

On the other hand, disagreements exist within and among groups on how to apply the CAPM to estimate cost of equity. The CAPM states that the required return (K) on any asset can be expressed as

$$K = R_f + \beta(R_m - R_f) \quad (2)$$

where:

R_f = interest rate available on a risk-free bond.

R_m = return required to attract investors to hold the broad market portfolio of risky assets.

β = the relative risk of the particular asset.

According to CAPM then, the cost of equity, K_{equity}, for a company depends on three components: returns on risk-free bonds (R_f), the stock's equity beta which measures risk of the company's stock relative to other risky assets ($\beta = 1.0$ is average risk), and the market risk premium ($R_m - R_f$) necessary to entice investors to hold risky assets generally versus risk-free bonds. In theory, each of these components must be a forward looking estimate. Our survey results show substantial disagreements on all three components.

A. The Risk-Free Rate of Return

As originally derived, the CAPM is a single-period model, so the question of which interest rate best represents the risk-free rate never arises. But in a many-period world typically characterized by upward-sloping yield curves, the practitioner must choose. Our results show the choice is typically between the 90-day Treasury bill yield and a long-term Treasury bond yield (see Exhibit 3). (Because the yield curve is ordinarily relatively flat beyond ten years, the choice of which particular long-term

[9]For instance, even research supporting the CAPM has found that empirical data are better explained by an intercept higher than a risk-free rate and a price of beta risk less than the market risk premium. Ibbotson Associates (1994) offers such a modified CAPM in addition to the standard CAPM and other models, in its cost of capital service. Jagannathan and McGrattan (1995) provide a useful review of empirical evidence on the CAPM.

[10]See Gitman and Forrester (1977) and Gitman and Mercurio (1982).

Exhibit 2. General Survey Results

	Corporations	Financial Advisers	Textbooks/Tradebooks
1. Do you use DCF techniques to evaluate investment opportunities?	89%—Yes, as a primary tool. 7%—Yes, only as secondary tool. 4%—No	100%—Rely on DCF, comparable companies multiples, comparable transactions multiples. Of these, 10%—DCF is a primary tool. 10%—DCF is used mainly as a check. 80%—Weight the three approaches depending on purpose and type of analysis.	100%—Yes
2. Do you use any form of a cost of capital as your discount rate in your DCF analysis?	89%—Yes 7%—Sometimes 4%—N/A	100%—Yes	100%—Yes
3. For your cost of capital, do you form any combination of capital cost to determine a WACC?	85%—Yes 4%—Sometimes 4%—No 7%—N/A	100%—Yes	100%—Yes
4. What weighting factors do you use? target vs. current debt/equity market vs. book weights	*Target/Current Market/Book* 52%—Target 59%—Market 15%—Current 15%—Book 26%—Uncertain 19%—Uncertain 7%—N/A 7%—N/A	*Target/Current Market/Book* 90%—Target 90%—Market 10%—Current 10%—Book	*Target/Current Market/Book* 86%—Target 100%—Market 14%—Current/Target
5. How do you estimate your before tax cost of debt?	52%—Marginal cost 37%—Current average 4%—Uncertain 7%—N/A	60%—Marginal cost 40%—Current average	71%—Marginal cost 29%—No explicit recommendation
6. What tax rate do you use?	52%—Marginal or statutory 37%—Historical average 4%—Uncertain 7%—N/A	60%—Marginal or statutory 30%—Historical average 10%—Uncertain	71%—Marginal or statutory 29%—No explicit recommendation
7. How do you estimate your cost of equity? (If you do not use CAPM, skip to question 12.)	81%—CAPM 4%—Modified CAPM 15%—N/A	80%—CAPM 20%—Other (including modified CAPM)	100%—Primarily CAPM Other methods mentioned: Dividend-Growth Model, Arbitrage-Pricing Model.
8. As usually written, the CAPM version of the cost of equity has three terms: a risk-free rate, a volatility or beta factor, and a market-risk premium. Is this consistent with your company's approach?	85%—Yes 0%—No 15%—N/A	90%—Yes 10%—N/A	100%—Yes
9. What do you use for the risk-free rate?	4%—90-day T-Bill 7%—three- to seven-year Treasuries 33%—ten-year Treasuries 4%—20-year Treasuries 33%—ten- to 30-year Treasuries 4%—ten-years or 90-Day; Depends 15%—N/A (Many said they match the term of the risk-free rate to the tenor of the investment.)	10%—90-day T-Bill 10%—five- to ten-year Treasuries 30%—ten- to 30-year Treasuries 40%—30-year Treasuries 10%—N/A	43%—T-Bills 29%—LT Treasuries 14%—Match tenor of investment 14%—Don't say

Exhibit 2. General Survey Results *(Continued)*

	Corporations	Financial Advisers	Textbooks/Tradebooks
10. What do you use as your volatility or beta factor?	52%—Published source 3%—Financial adviser's estimate 30%—Self calculated 15%—N/A	30%—Fundamental beta (e.g., BARRA) 40%—Published source 20%—Self calculated 10%—N/A	100%—Mention availability of published sources
11. What do you use as your market-risk premium?	11%—Use fixed rate of 4.0-4.5% 37%—Use fixed rate of 5.0-6.0% 4%—Use geometric mean 4%—Use arithmetic mean 4%—Use average of historical and implied 15%—Use financial adviser's estimate 7%—Use premium over treasuries 3%—Use Value Line estimate 15%—N/A	10%—Use fixed rate of 5.0% 50%—Use 7.0-7.4% (Similar to arithmetic) 10%—LT arithmetic mean 10%—Both LT arithmetic and geometric mean 10%—Spread above treasuries 10%—N/A	71%—Arithmetic historical mean 15%—Geometric historical mean 14%—Don't say
12. Having estimated your company's cost of capital, do you make any further adjustments to reflect the risk of individual investment opportunities?	26%—Yes 33%—Sometimes 41%—No	Not asked.	86%—Adjust beta for investment risk 14%—Don't say
13. How frequently do you re-estimate your company's cost of capital?	4%—Monthly 19%—Quarterly 11%—Semi-Annually 37%—Annually 7%—Continually/Every Investment 19%—Infrequently 4%—N/A (Generally, many said that in addition to scheduled reviews, they re-estimate as needed for significant events such as acquisitions and high-impact economic events.)	Not asked.	100%—No explicit recommendation
14. Is the cost of capital used for purposes other than project analysis in your company? (For example, to evaluate divisional performance?)	51%—Yes 44%—No 4%—N/A	Not asked.	100%—No explicit discussion
15. Do you distinguish between strategic and operational investments? Is cost of capital used differently in these two categories?	48%—Yes 48%—No 4%—N/A	Not asked.	29%—Yes 71%—No explicit discussion
16. What methods do you use to estimate terminal value? Do you use the same discount rate for the terminal value as for the interim cash flows?	Not asked.	30%—Exit multiples only 70%—Both multiples and perpetuity DCF model 70%—Use same WACC for TV 20%—No response 10%—Rarely change	71%—Perpetuity DCF model 29%—No explicit discussion 100%—No explicit discussion of separate WACC for terminal value

Exhibit 2. General Survey Results *(Continued)*

	Corporations	Financial Advisers	Textbooks/Tradebooks
17. In valuing a multidivisional company, do you aggregate the values of the individual divisions, or just value the firm as a whole? If you value each division separately, do you use a different cost of capital for each one?	Not asked.	100%—Value the parts 100%—Use different WACCs for separate valuations	100%—Use distinct WACC for each division
18. In your valuations do you use any different methods to value synergies or strategic opportunities (e.g., higher or lower discount rates, options valuation)?	Not asked.	30%—Yes 50%—No 20%—Rarely	29%—Use distinct WACC for synergies 71%—No explicit discussion
19. Do you make any adjustments to the risk premium for changes in market conditions?	Not asked.	20%—Yes 70%—No 10%—N/A	14%—Yes 86%—No explicit discussion
20. How long have you been with the company? What is your job title?	10 years—Mean All senior, except one	7.3 years—Mean 4—MDs, 2—VPs, 4—Associates	N/A

yield to use is not a critical one.)[11] The difference between realized returns on the 90-day T-bill and the ten-year T-bond has averaged 150 basis points over the long-run: so choice of a risk-free rate can have a material effect on the cost of equity and WACC.[12]

The 90-day T-bill yields are more consistent with the CAPM as originally derived and reflect truly risk-free returns in the sense that T-bill investors avoid material loss in value from interest rate movements. However, long-term bond yields more closely reflect the default-free holding period returns available on long lived investments and thus more closely mirror the types of investments made by companies.

Our survey results reveal a strong preference on the part of practitioners for long-term bond yields. Of both corporations and financial advisers, 70% use Treasury bond yields maturities of ten years or greater. None of the financial advisers and only 4% of the corporations used the Treasury bill yield. Many corporations said they matched the term of the risk-free rate to the tenor of the investment. In contrast, 43% of the books advocated the T-bill yield, while only 29% used long-term Treasury yields.

B. Beta Estimates

Finance theory calls for a forward-looking beta, one reflecting investors' uncertainty about the future cash flows to equity. Because forward-looking betas are unobservable, practitioners are forced to rely on proxies of various kinds. Most often this involves using beta estimates derived from historical data and published by such sources as Bloomberg, Value Line, and Standard & Poor's.

The usual methodology is to estimate beta as the slope coefficient of the market model of returns.

$$R_{it} = \alpha_i + \beta_i(R_{mt}) \quad (3)$$

where

R_{it} = return on stock i in time period (e.g., day, week, month) t,

[11]In early January 1996, the differences between yields on the ten- and 30-year T-bonds were about 35 basis points. Some aficionados will argue that there *is* a difference between the ten- and 30-year yields. Ordinarily the yield curve declines just slightly as it reaches the 30-year maturity—this has been explained to us as the result of life insurance companies and other long-term buy-and-hold investors who are said to purchase the long bond in significant volume. It is said that these investors command a lower liquidity premium than the broader market, thus driving down yields. If this is true, then the yields at this point of the curve may be due not to some ordinary process of rational expectations, but rather to an anomalous supply-demand imbalance, which would render these yields less trustworthy. The counterargument is that life insurance companies could be presumed to be rational investors too. As buy-and-hold investors, they will surely suffer the consequences of any irrationality, and therefore have good motive to invest for yields "at the market."

[12]This was estimated as the difference in arithmetic mean returns on long-term government bonds and US Treasury bills over the years 1926 to 1994, given by Ibbotson Associates (1995).

Exhibit 3. Choice of Bond Market Proxy

Some of our best-practice companies noted that their choice of a bond market proxy for a risk-free rate depended specifically on how they were proposing to spend funds. We asked, "What do you use for a risk-free rate?" and heard the following:

- "Ten-year Treasury bond or other duration Treasury bond if needed to better match project horizon."
- "We use a three- to five-year Treasury note yield, which is the typical length of our company's investment. We match our average investment horizon with maturity of debt."

R_{mt} = return on the market portfolio in period t,
α_i = regression constant for stock i, and
β_i = beta for stock i.

In addition to relying on historical data, use of this equation to estimate beta requires a number of practical compromises, each of which can materially affect the results. For instance, increasing the number of time periods used in the estimation may improve the statistical reliability of the estimate but risks the inclusion of stale, irrelevant information. Similarly, shortening the observation period from monthly to weekly, or even daily, increases the size of the sample but may yield observations that are not normally distributed and may introduce unwanted random noise. A third compromise involves choice of the market index. Theory dictates that R_m is the return on the market portfolio, an unobservable portfolio consisting of *all* risky assets, including human capital and other nontraded assets, in proportion to their importance in world wealth. Beta providers use a variety of stock market indices as proxies for the market portfolio on the argument that stock markets trade claims on a sufficiently wide array of assets to be adequate surrogates for the unobservable market portfolio.

Exhibit 4 shows the compromises underlying the beta estimates of three prominent providers and their combined effect on the beta estimates of our sample companies. Note for example that the mean beta of our sample companies according to Bloomberg is 1.03, while the same number according to Value Line is 1.24. Exhibit 5 provides a complete list of sample betas by publisher.

Over half of the corporations in our sample (item ten, Exhibit 2) rely on published sources for their beta estimates, although 30% calculate their own. Among financial advisers, 40% rely on published sources, 20% calculate their own, and another 40% use what might be called "fundamental" beta estimates. These are estimates which use multi-factor statistical models drawing on fundamental indices of firm and industry risk to estimate company betas. The best known provider of fundamental beta estimates is the consulting firm BARRA.

Exhibit 4. Compromises Underlying Beta Estimates and Their Effect on Estimated Betas of Sample Companies

	Bloomberg[a]	Value Line	Standard & Poor's
Number	102	260	60
Time Interval	wkly (2 yrs.)	wkly (5 yrs.)	mthly(5 yrs.)
Market Index Proxy	S&P 500	NYSE composite	S&P 500
Mean Beta	1.03	1.24	1.18
Median Beta	1.00	1.20	1.21

[a]With the Bloomberg service, it is possible to estimate a beta over many differing time periods, market indices, and as smoothed or unadjusted. The figures presented here represent the base-line or default-estimation approach used if other approaches are not specified.

Within these broad categories, a number of survey participants indicated use of more pragmatic approaches, which combine published beta estimates or adjust published estimates in various heuristic ways. (See Exhibit 6.)

C. Equity Market Risk Premium

This topic prompted the greatest variety of responses among survey participants. Finance theory says the equity market risk premium should equal the excess return expected by investors on the market portfolio relative to riskless assets. How one measures expected future returns on the market portfolio and on riskless assets are problems left to practitioners. Because expected future returns are unobservable, all survey respondents extrapolated historical returns into the future on the presumption that past experience heavily conditions future expectations. Where respondents chiefly differed was in their use of *arithmetic* versus *geometric* average historical equity returns and in their choice of realized returns on T-bills versus T-bonds to proxy for the return on riskless assets.

The arithmetic mean return is the simple average of past returns. Assuming the distribution of returns is stable over time and that periodic returns are independent of one another, the arithmetic return is the best estimator of expected return.[13] The geometric mean return is the internal rate of return between a single outlay and one or more future receipts. It

[13]Several studies have documented significant negative autocorrelation in returns—this violates one of the essential tenets of the arithmetic calculation since, if returns are not serially independent, the simple arithmetic mean of a distribution will not be its expected value. The autocorrelation findings are reported by Fama and French (1986), Lo and MacKinlay (1988), and Poterba and Summers (1988).

Exhibit 5. Betas for Corporate Survey Respondents

In this exhibit, Bloomberg's adjusted beta is $\beta_{adj} = (0.66)\beta_{raw} + (0.33)1.00$ and Value Line reported only Total Debt/Total Cap for these firms, except in the case of US West, in which LT Debt/Total Cap was reported.

	Bloomberg Betas				Range
	Raw	Adjusted	Value Line Betas	S&P Betas	Max. - Min.
Advanced Micro	1.20	1.13	1.70	1.47	0.57
Allergan	0.94	0.96	1.30	1.36	0.42
Black & Decker	1.06	1.04	1.65	1.78	0.74
Cellular One			Not Listed		
Chevron	0.70	0.80	0.70	0.68	0.12
Colgate-Palmolive	1.11	1.07	1.20	0.87	0.33
Comdisco	1.50	1.34	1.35	1.20	0.30
Compaq	1.26	1.18	1.50	1.55	0.37
Eastman Kodak	0.54	0.69	NMF	0.37	0.32
Gillette	0.93	0.95	1.25	1.30	0.37
Guardian Industries			Not Listed		
Henkel			Not Listed		
Hewlett-Packard	1.34	1.22	1.40	1.96	0.74
Kantlal			Not Listed		
Lawson Mardon			Not Listed		
McDonald's	0.93	0.96	1.05	1.09	0.16
Merck	0.73	0.82	1.10	1.15	0.42
Monsanto	0.89	0.93	1.10	1.36	0.47
PepsiCo	1.12	1.08	1.10	1.19	0.11
Quaker Oats	1.38	1.26	0.90	0.67	0.71
Schering-Plough	0.51	0.67	1.00	0.82	0.49
Tandem	1.35	1.23	1.75	1.59	0.52
Union Carbide	1.51	1.34	1.30	0.94	0.57
US West	0.61	0.74	0.75	0.53	0.22
Walt Disney	1.42	1.28	1.15	1.22	0.27
Weyerhauser	0.78	0.85	1.20	1.21	0.43
Whirlpool	0.90	0.93	1.55	1.58	0.68
Mean	1.03	1.02	1.24	1.18	0.42
Median	1.00	1.00	1.20	1.21	0.42
Standard Deviation	0.31	0.21	0.29	0.41	0.19

measures the compound rate of return investors earned over past periods. It accurately portrays historical investment experience. Unless returns are the same each time period, the geometric average will always be less than the arithmetic average, and the gap widens as returns become more volatile.[14]

[14]For large samples of returns, the geometric average can be approximated as the arithmetic average minus one half the variance of realized returns. Ignoring sample size adjustments, the variance of returns in the current example is 0.09 yielding an estimate of 0.10 - ½(0.09) = 0.055 = 5.5% versus the actual 5.8% figure. Kritzman (1994) provides an interesting comparison of the two types of averages.

Based on Ibbotson Associates' data (1995) from 1926 to 1995, Exhibit 7 illustrates the possible range of equity market risk premiums depending on use of the geometric as opposed to the arithmetic mean equity return and on use of realized returns on T-bills as opposed to T-bonds.[15] Even wider variations in market risk premiums can arise when one changes the historical period for averaging. Extending US stock experience

[15]These figures are drawn from Table 2-1, Ibbotson Associates (1995), where the R_m was drawn from the "Large Company Stocks" series, and R_f drawn from the "Long-Term Government Bonds" and "US Treasury Bills" series.

Exhibit 6. Beta Factor

We asked our sample companies, "What do you use as your volatility or beta factor?" A sampling of responses shows the choice is not always a simple one.

- "We use adjusted betas reported by Bloomberg. At times, our stock has been extremely volatile. If at a particular time the factor is considered unreasonably high, we are apt to use a lower (more consistent) one."
- "We begin with the observed 60-month covariance between our stock and the market. We also consider, Value Line, Barra, S&P betas for comparison and may adjust the observed beta to match assessment of future risk."
- "We average Merrill Lynch and Value Line figures and use Bloomberg as a check."
- "We do not use betas estimated on our stock directly. Our company beta is built up as a weighted average of our business segment betas—the segment betas are estimated using pure-play firm betas of comparable companies."

Exhibit 7. The Equity Market Risk Premium ($R_m - R_f$)

	T-Bill Returns	T-Bond Returns
Arithmetic Mean Return	8.5%	7.0%
Geometric Mean Return	6.5%	5.4%

back to 1802, Siegel (1992) shows that historical market premia have changed over time and were typically lower in the pre-1926 period. Carleton and Lakonishok (1985) illustrate considerable variation in historical premia using different time periods and methods of calculation even with data since 1926.

Of the texts and tradebooks in our survey, 71% support use of the arithmetic mean return over T-bills as the best surrogate for the equity market risk premium. For long-term projects, Ehrhardt (1994) advocates forecasting the T-bill rate and using a different cost of equity for each future time period. Kaplan and Ruback (1995) studied the equity risk premium implied by the valuations in highly leveraged transactions and estimated a mean premium of 7.97%, which is most consistent with the arithmetic mean and T-bills. A minority view is that of Copeland, Koller, and Murrin (1990), "We believe that the geometric average represents a better estimate of investors' expected over long periods of time." Ehrhardt (1994) recommends use of the geometric mean return if one believes stockholders are buy-and-hold investors.

Half of the financial advisers queried use a premium consistent with the arithmetic mean and T-bill returns, and many specifically mentioned use of the arithmetic mean. Corporate respondents, on the other hand, evidenced more diversity of opinion and tend to favor a lower market premium: 37% use a premium of 5-6%, and another 11% use an even lower figure.

Comments in our interviews (see Exhibit 8) suggest the diversity among survey participants. While most of our 27 sample companies appear to use a 60+-year historical period to estimate returns, one cited a window of less than ten years, two cited windows of about ten years, one began averaging with 1960, and another with 1952 data.

This variety of practice should not come as a surprise since theory calls for a forward-looking risk premium, one that reflects current market sentiment and may change with market conditions. What is clear is that there is substantial variation as practitioners try to operationalize the theoretical call for a market risk premium. A glaring result is that few respondents specifically cited use of any forward-looking method to supplement or replace reading the tea leaves of past returns.[16]

IV. The Impact of Various Assumptions for Using CAPM

To illustrate the effect of these various practices, we estimated the hypothetical cost of equity and WACC for Black & Decker, which we identified as having a wide range in estimated betas, and for McDonald's, which has a relatively narrow range. Our estimates are "hypothetical" in that we do not adopt any information supplied to us by the companies but rather apply a range of approaches based on publicly available information as of late 1995. Exhibit 9 gives Black & Decker's estimated costs of equity and WACCs under various combinations of risk-free rate, beta, and market risk premia. Three clusters of practice are illustrated, each in turn using three betas as provided by S & P, Value Line, and Bloomberg (unadjusted). The first approach, as suggested by some texts, marries a short-term risk-free rate (90-day T-bill yield) with Ibbotson's arithmetic mean (using T-bills) risk

[16]Only two respondents (one adviser and one company) specifically cited forward-looking estimates although others cited use of data from outside sources (e.g., a company using an estimate from an investment bank) where we cannot identify whether forward-looking estimates were used. Some studies using financial analyst forecasts in dividend growth models suggest market risk premia average in the 6 to 6.5% range and change over time with higher premia when interest rates decline. See for instance, Harris and Marston (1992). Ibbotson Associates (1994) provides industry-specific cost-of-equity estimates using analysts' forecasts in a growth model.

Exhibit 8. Market Risk Premium

"What do you use as your market risk premium?" A sampling of responses from our best-practice companies shows the choice can be a complicated one.

- "Our 400 basis point market premium is based on the historical relationship of returns on an actualized basis and/or investment bankers' estimated cost of equity based on analysts' earnings projections."
- "We use an Ibbotson arithmetic average starting in 1960. We have talked to investment banks and consulting firms with advice from 3-7%."
- "A 60-year average of about 5.7%. This number has been used for a long time in the company and is currently the subject of some debate and is under review. We may consider using a time horizon of less than 60 years to estimate this premium."
- "We are currently using 6%. In 1993, we polled various investment banks and academic studies on the issue as to the appropriate rate and got anywhere between 2 and 8%, but most were between 6 and 7.4%."

Comments from financial advisers also were revealing. While some simply responded that they use a published historical average, others presented a more complex picture.

- "We employ a self-estimated 5% (arithmetic average). A variety of techniques are used in estimation. We look at Ibbotson data and focus on more recent periods, around 30 years (but it is not a straight 30-year average). We use smoothing techniques, Monte Carlo simulation and a dividend discount model on the S&P 400 to estimate what the premium should be, given our risk-free rate of return."
- "We use a 7.4% arithmetic mean, after Ibbotson, Sinquefeld. We used to use the geometric mean following the then scholarly advice, but we changed to the arithmetic mean when we found later that our competitors were using the arithmetic mean and scholars' views were shifting."

premium. The second, adopted by a number of financial advisers, uses a long-term risk-free rate (30-year T-bond yield) and a risk premium of 7.2% (the modal premium mentioned by financial advisers). The third approach also uses a long-term risk-free rate but adopts the modal premium mentioned by corporate respondents of 5.5%. We repeated these general procedures for McDonald's.

The resulting ranges of estimated WACCs for the two firms are:

	Maximum WACC	Minimum WACC	Difference in Basis Points
Black & Decker	12.80%	8.50%	430
McDonald's	11.60%	9.30%	230

The range from minimum to maximum is large for both firms, and the economic impact is potentially stunning. To illustrate this, the present value of a level perpetual annual stream of $10 million would range between $78 million and $118 million for Black and Decker, and between $86 million and $108 million for McDonald's.

Given the positive but relatively flat slope of the yield curve in late 1995, most of the variation in our illustration is explained by beta and the equity market premium assumption. Variations can be even more dramatic, especially when the yield curve is inverted.

V. Risk Adjustments to WACC

Finance theory is clear that a single WACC is appropriate only for investments of broadly comparable risk: a firm's overall WACC is a suitable benchmark for a firm's average risk investments. Finance theory goes on to say that such a company-specific figure should be adjusted for departures from such an average risk profile. Attracting capital requires payment of a premium that depends on risk.

We probed whether firms use a discount rate appropriate to the risks of the flows being valued in questions on types of investment (strategic vs. operational), terminal values, synergies, and multidivisional companies. Responses to these questions displayed in Exhibit 2 do not display much apparent alignment of practice. When financial advisers were asked how they value parts of multidivision firms, all ten firms surveyed reported that they use different discount rates for component parts (item 17). However, only 26% of companies always adjust the cost of capital to reflect the risk of individual investment opportunities (item 12). Earlier studies (summarized in Gitman and Mercurio, 1982) reported that between one-third and one-half of the firms surveyed did *not* adjust for risk differences among capital projects. These practices stand in stark contrast

Exhibit 9. Variations in Cost of Capital (WACC) Estimates for Black and Decker Using Different Methods of Implementing the Capital-Asset Pricing Model

In this Exhibit, in all cases the CAPM is used to estimate the cost of equity, the cost of debt is assumed to be 7.81% based on a Baa rating, the tax rate is assumed to be 38%, and debt is assumed to represent 49% of capital.

Panel A. Short-Term Rate Plus Arithmetic Average Historical Risk Premium

(recommended by some texts)
R_f = 5.36%, 90-day T-bills
$R_m - R_f$ = 8.50%, Ibbotson arithmetic average since 1926

	Cost of Equity	Cost of Capital
Beta Service	K_e	WACC
Bloomberg, β = 1.06	14.40%	9.70%
Value Line, β = 1.65	19.40%	12.20%
S&P, β = 1.78	20.25%	12.80%

Panel B. Long-Term Rate Plus Risk Premium of 7.20%

(modal practice of financial advisers surveyed)
R_f = 6.26%, 30-year T-bonds
$R_m - R_f$ = 7.20%, modal response of financial advisers

	Cost of Equity	Cost of Capital
Beta Service	K_e	WACC
Bloomberg, β = 1.06	13.90%	9.40%
Value Line, β = 1.65	18.10%	11.60%
S&P, β = 1.78	19.10%	12.10%

Panel C. Long-Term Rate Plus Risk Premium of 5.50%

(modal practice of corporations surveyed)
R_f = 6.26%, 30-year T-bonds
$R_m - R_f$ = 5.50%, modal response of corporations

	Cost of Equity	Cost of Capital
Beta Service	K_e	WACC
Bloomberg, β = 1.06	12.10%	8.50%
Value Line, β = 1.65	15.30%	10.20%
S&P, β = 1.78	16.10%	10.50%

to the recommendations of textbooks and tradebooks: the books did not explicitly address all subjects, but when they did, they were uniform in their advocacy of risk-adjusted discount rates.

A closer look at specific responses reveals the tensions as theory based on traded financial assets is adapted to decisions on investments in real assets. Inevitably, a fine line is drawn between use of financial market data versus managerial judgments. Responses from financial advisers illustrate this. As shown in Exhibit 2, all advisers use different capital costs for valuing parts (e.g., divisions) of a firm (item 17); only half ever select different rates for synergies or strategic opportunities (item 18); only one in ten state any inclination to use different discount rates for terminal values and interim cash flows (item 16). Two simplistic interpretations are that 1) advisers ignore important risk differences, or 2) material risk differences are rare in assessing factors such as terminal values. Neither of these fit; our conversations with advisers reveal that they recognize important risk differences but deal with them in a multitude of ways. Consider comments from two prominent investment banks who use different capital costs for valuing parts of multidivision firms. When asked about risk adjustments for prospective merger synergies, these same firms responded:

- "We make these adjustments in cash flows and multiples rather than in discount rates."
- "Risk factors may be different for realizations of synergies, but we make adjustments to cash flows rather than the discount rate."

While financial advisers typically value existing companies, corporations face further challenges. They routinely must evaluate investments in new products and technologies. Moreover, they deal in an administrative setting that melds centralized (e.g., calculating a WACC) and decentralized (e.g., specific project appraisal) processes. As Exhibit 10 illustrates, these complexities lead to a blend of approaches for dealing with risk. A number of respondents mentioned specific rate adjustments to distinguish between divisional capital costs, international versus domestic investments and leasing versus nonleasing situations.

Exhibit 10. Adjustments for Project Risk

When asked whether they adjusted discount rates for project risk, companies provided a wide range of responses.

- "No, it's difficult to draw lines between the various businesses we invest in and we also try as best we can to make adjustments for risk in cash flow projections rather than in cost of capital factors...We advocate minimizing adjustments to cost of capital calculations and maximizing understanding of all relevant issues, e.g., commodity costs and international/political risks." At another point the same firm noted that "for lease analysis only the cost of debt is used."
- "No (we don't risk adjust cost of capital). We believe there are two basic components: 1) projected cash flows, which should incorporate investment risk, and 2) discount rate." The same firm noted, however: "For international investments, the discount rate is adjusted for country risk." and "For large acquisitions, the company takes significantly greater care to estimate an accurate cost of capital."
- "No, but use divisional costs of capital to calculate a weighted average company cost of capital . . . for comparison and possible adjustment."
- "Yes, we have calculated a cost of capital for divisions based on pure play betas and also suggest subjective adjustments based on each project. Our feeling is that use of divisional costs is the most frequent distinction in the company."
- "Rarely, but at least on one occasion we have for a whole new line of business."
- "We do sensitivity analysis on every project."
- "For the most part we make risk adjustments qualitatively i.e., we use the corporate WACC to evaluate a project, but then interpret the result according to the risk of the proposal being studied. This could mean that a risky project will be rejected even though it meets the corporate hurdle rate objectives."
- "No domestically; yes internationally—we assess a risk premium per country and adjust the cost of capital accordingly."

In other instances, however, these same respondents favored cash flow adjustments to deal with risks.

Why do practitioners risk adjust discount rates in one case and work with cash flow adjustments in another? Our interpretation is that risk-adjusted discount rates are more likely used when the analyst can establish relatively objective financial market benchmarks for what rate adjustments should be. At the business (division) level, data on comparable companies provide cost-of-capital estimates. Debt markets provide surrogates for the risks in leasing cash flows. International financial markets shed insights on cross-country differences. When no such market benchmarks are available, practitioners look to other methods for dealing with risks. Lacking a good market analog from which to glean investor opinion (in the form of differing capital costs), the analyst is forced to rely more on internal focus. Practical implementation of risk-adjusted discount rates thus appears to depend on the ability to find traded financial assets that are comparable in risk to the cash flows being valued and then to have financial data on these traded assets.

The pragmatic bent of application also comes to the fore when companies are asked how often they reestimate capital costs (item 13, Exhibit 2). Even for those firms who reestimate relatively frequently, Exhibit 11 shows that they draw an important distinction between estimating capital costs and policy changes about the capital cost figure used in the firm's decision making. Firms consider administrative costs in structuring their policies on capital costs. For a very large venture (e.g. an acquisition), capital costs may be revisited each time. On the other hand, only large material changes in costs may be fed into more formal project evaluation systems. Firms also recognize a certain ambiguity in any cost number and are willing to live with approximations. While the bond market reacts to minute basis point changes in investor return requirements, investments in real assets, where the decision process itself is time consuming and often decentralized, involve much less precision. To paraphrase one of our sample companies, we use capital costs as a rough yardstick rather than the last word in project evaluation.

Our interpretation is that the mixed responses to questions about risk adjusting and reestimating discount rates reflect an often sophisticated set of practical tradeoffs; these involve the size of risk differences, the quality of information from financial markets, and the realities of administrative costs and processes. In cases where there are material

Exhibit 11. Cost-of-Capital Estimates

How frequently do you re-estimate your company's cost of capital? Here are responses from best-practice companies.

- "We usually review it quarterly but would review more frequently if market rates changed enough to warrant the review. We would only announce a change in the rate if the recomputed number was materially different than the one currently being used."
- "We reestimate it once or twice a year, but we rarely change the number that the business units use for decision and planning purposes. We expect the actual rate to vary over time, but we also expect that average to be fairly constant over the business cycle. Thus, we tend to maintain a steady discount rate within the company over time."
- "Usually every six months, except in cases of very large investments, in which it is reestimated for each analysis."
- "Whenever we need to, such as for an acquisition or big investment proposal."
- "Re-evaluate as needed e.g., for major tax changes, but unless the cost of capital change is significant (a jump to 21%, for instance), our cutoff rate is not changed; it is used as a *yardstick* rather than the last word in project evaluation."
- "Probably need 100 basis point change to publish a change. We report only to the nearest percent."

differences in perceived risk, a sufficient scale of investment to justify the effort, no large scale administrative complexities, and readily identifiable information from financial markets, practitioners employ risk adjustments to rates quite routinely. Acquisitions, valuing divisions of companies, analysis of foreign versus domestic investments, and leasing versus nonleasing decisions were frequently cited examples. In contrast, when one or more of these factors is not present, practitioners are more likely to employ other means to deal with risks.

VI. Conclusions

Our research sought to identify the "best practice" in cost-of-capital estimation through interviews of leading corporations and financial advisers. Given the huge annual expenditure on capital projects and corporate acquisitions each year, the wise selection of discount rates is of material importance to senior corporate managers.

The survey revealed broad acceptance of the WACC as the basis for setting discount rates. In addition, the survey revealed general alignment in many aspects of the estimation of WACC. The main area of notable disagreement was in the details of implementing CAPM to estimate the cost of equity. This paper outlined the varieties of practice in CAPM use, the arguments in favor of different approaches, and the practical implications.

In summary, we believe that the following elements represent best current practice in the estimation of WACC:

- Weights should be based on *market-value* mixes of debt and equity.
- The after-tax cost of debt should be estimated from *marginal* pretax costs, combined with *marginal or statutory* tax rates.
- CAPM is currently the preferred model for estimating the cost of equity.
- Betas are drawn substantially from published sources, preferring those betas using a long interval of equity returns. Where a number of statistical publishers disagree, best practice often involves judgment to estimate a beta.
- Risk-free rate should match the tenor of the cash flows being valued. For most capital projects and corporate acquisitions, the yield on the US government Treasury bond of ten or more years in maturity would be appropriate.
- Choice of an equity market risk premium is the subject of considerable controversy both as to its value and method of estimation. Most of our best-practice companies use a premium of 6% or lower while many texts and financial advisers use higher figures.
- Monitoring for changes in WACC should be keyed to major changes in financial market conditions, but should be done at least annually. Actually flowing a change through a corporate system of project valuation and compensation targets must be done gingerly and only when

there are material changes.

- WACC should be risk adjusted to reflect substantive differences among different businesses in a corporation. For instance, financial advisers generally find the corporate WACC to be inappropriate for valuing different parts of a corporation. Given publicly traded companies in different businesses, such risk adjustment involves only modest revision in the WACC and CAPM approaches already used. Corporations also cite the need to adjust capital costs across national boundaries. In situations where market proxies for a particular type of risk class are not available, best practice involves finding other means to account for risk differences.

Best practice is largely consistent with finance theory. Despite broad agreement at the theoretical level, however, several problems in application remain that can lead to wide divergence in estimated capital costs. Based on these remaining problems, we believe that further applied research on two principal topics is warranted. First, practitioners need additional tools for sharpening their assessment of relative risk. The variation in company-specific beta estimates from different published sources can create large differences in capital-cost estimates. Moreover, use of risk-adjusted discount rates appears limited by lack of good market proxies for different risk profiles. We believe that appropriate use of averages across industry or other risk categories is an avenue worth exploration. Second, practitioners could benefit from further research on estimating equity market risk premia. Current practice displays large variations and focuses primarily on averaging past data. Use of expectational data appears to be a fruitful approach. As the next generation of theories gradually sharpen our insights, we feel that research attention to implementation of existing theory can make for real improvements in practice.

Finally our research is a reminder of the old saying that too often in business we measure with a micrometer, mark with a pencil, and cut with an ax. Despite the many advances in finance theory, the particular "ax" available for estimating company capital costs remains a blunt one. Best-practice companies can expect to estimate their weighted average cost of capital with an accuracy of no more than plus or minus 100 to 150 basis points. This has important implications for how managers use the cost of capital in decision making. First, do not mistake capital budgeting for bond pricing. Despite the tools available, effective capital appraisal continues to require thorough knowledge of the business and wise business judgment. Second, be careful not to throw out the baby with the bath water. Do not reject the cost of capital and attendant advances in financial management because your finance people are not able to give you a precise number. When in need, even a blunt ax is better than nothing. ■

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