Why do firms use high discount rates?*

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Abstract

We find that firms use discount rates that are on average twice their cost of financial capital, based on an original survey of CFOs with firm identifiers linked to responses. Under the standard corporate finance paradigm, firms take all projects that return more than their cost of financial capital unless they are constrained. We explore the nature of the constraints that lead firms to increase their discount rates. Firms that use high discount rates describe themselves as facing operational constraints but not financial constraints. Consistent with this explanation, firms using high discount rates relative to their cost of financial capital have strong balance sheets, low leverage, and large cash holdings. These firms appear to be conserving managerial bandwidth and manpower by forgoing good projects while preparing for even better investment opportunities to arise.

Keywords: Capital budgeting; discount rates; cost of capital.

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I. Introduction

Capital allocation, a crucial business function, is not well understood. While most large U.S. firms have long used discounted cash flow (DCF) methods to evaluate investment opportunities, little is known about what factors determine the discount rate that firms use. Surveys on capital budgeting conducted over the past 25 years find that firms are increasingly using the capital asset pricing model (CAPM) to estimate their cost of equity and the weighted average cost of capital (WACC) to discount a project’s unlevered cash flows. Although CAPM and WACC are the focus of capital budgeting instruction in textbooks and business school classrooms (Womack and Zhang, 2005), we find that they represent only half of a firm’s discount rate.

CAPM and WACC account only for a project’s systematic risk and leverage. In valuing a project, firms can account for additional risks and strategic factors in one of two ways. First, they can adjust the expected project cash flows down for additional risks and up for strategic benefits. Alternatively, firms can account for these factors by modifying the rate used to discount the projects’ cash flows. It is common, for example, for firms to account for the tax benefits of debt by adjusting the discount rate (i.e., compute WACC), rather than by using the unlevered cost of capital and adding an estimate of the discounted value of the tax shield; although both approaches, when applied properly, give the same answer. Indeed, Graham and Harvey (2001) report that only 10.8% of the respondents to their survey use Adjusted Present Value (APV) on a regular basis. Similarly, it is common for firms to evaluate a “strategic” project by adjusting the discount rate, rather than by valuing potential future follow-on projects separately.

We find that, in practice, firms adjust discount rates to account for additional factors. Our survey firms use, on average, a discount rate of 15% while their WACC is 8%. This finding remains unchanged when using the Fama-French 3-factor model or models accounting for inflation, currency, or macroeconomic risk factors instead of the CAPM to compute the firms’ cost of equity. We find that firms tend to use discount rates that account for idiosyncratic risk, but this also cannot explain the gap between discount rates and the cost of financial capital. In sum, firms use discount rates that exceed their cost of financial capital as measured by their WACC.
Using higher discount rates may be justified in the presence of some forms of constraint or
friction. Otherwise, the discount rate should equal the firm’s cost of financial capital and a firm
should invest in every positive NPV project. We examine various explanations for why firms use
discount rates that exceed their cost of financial capital, i.e., why firms forgo some apparently
profitable investment opportunities. The traditional view is that financially constrained firms
have to ration their available capital and forgo some profitable opportunities. In contrast, we find
that financially constrained firms—identified in various ways—use discount rates closer to their
cost of capital, while firms with ample financial flexibility in the form of low debt ratios and high
cash balances use higher discount rates. We find no evidence that the high discount rates are used
within firms’ internal capital markets to account for optimistic cash flow estimates. Neither can
the measures of the propensity for short-termism (or managerial myopia) that we use explain the
high discount rates.

An alternative explanation is that managerial and organizational constraints prevent firms from
undertaking all opportunities as they arise, leading them to be pickier in selecting investment
opportunities. Theory suggests that firms facing such constraints tend to hoard cash while waiting
for better investment opportunities to emerge (Asvanunt, Broadie, and Sundaresan, 2011). Consistent with this view, we find that firms with (self-identified) managerial constraints and
significant cash balances use higher discount rates to screen their investment opportunities.
Operational constraints thus appear to play an important role in capital budgeting decisions.

The remainder of the paper is organized as follows. In Section II, we describe the survey design,
auxiliary data sources, and self-reported discount rates. We model firms’ discount rates as a
function of their costs of financial capital in Section III and evaluate potential explanations of
why firms use high discount rates in Section IV. We conclude in Section V.

II. Survey Design and Data Description

A. Survey Design

Because discount rates cannot be observed in archival databases, we surveyed firms directly. To
relate firms’ discount rates to their cost of financial capital, we then combined their survey
answers with data from Barra, CRSP, and Compustat. To our knowledge, aside from Poterba and Summers (1995), ours is the only survey on discount rates for capital budgeting that includes the identity of the respondents. This enables us to combine survey responses with information from financial databases to examine the determinants of firms’ discount rates.

Survey data has strengths and weaknesses. Surveys are the only way to obtain the discount rates that firms use in practice. On the downside, surveys typically have low response rates and there may be systematic differences between those who respond and those who do not. Additionally, participants may interpret a survey question in different ways. In designing the questionnaire, we followed standard practices in the fields of psychology and marketing to avoid potential biases (Gillman, 2000; Morgan, 1988). For example, it is well recognized that respondents to surveys tend to try to please the conductor of the survey by providing the answers they think the survey’s author expects (Singer and Presser, 1989). Therefore, in designing the survey questions we tried to avoid using terms such as “cost of capital” and “CAPM” which could trigger respondents to answer what they may recall from their MBA courses on corporate finance. We also solicited and received input from numerous finance academics in designing the questions. Finally, we invited six CFOs from the Chicago area to a focus group meeting to test the survey with practitioners. After filling out the survey, we discussed each question to assure that the wording was not ambiguous. The survey was sent out in October 2003 with a cover letter from the Dean Emeritus of the Kellogg School of Management, Donald Jacobs, along with a postage-paid return envelope to a total of 4,600 CFOs of U.S. companies listed in the Compustat name file.¹ We asked the participants to return the questionnaire within ten days. A week after the initial mailing we sent a follow-up mailing.

The survey was completed by the CFOs of 127 companies, 113 public, and 14 private. A high percentage of the respondents revealed their identities (87.4%). Almost all surveys returned were filled out completely and there was no decline in the number of responses towards the end of the four-page questionnaire. We believe that most respondents were actually the CFOs themselves as

¹ We exclude all finance and insurance companies with the major SIC code in the ranges 6000-6499, 6700-6799, as well as health, education, social services, and museums (7200+). We also drop radio and TV broadcasting, cable, and other pay TV services, as these firms might be driven by non-commercial interests, e.g. religious radio stations (4840-4949).
we received e-mails from the CFOs of most responding companies requesting an advance copy of the survey results. In addition, many respondents provided elaborate comments to open questions. The survey responses appear to be accurate. For example, the self-reported sales figures agree with numbers retrieved from Compustat for 92.3% of the responses.

**B. Firm Characteristics**

Table I shows the characteristics of the 86 public firms responding to our survey, providing a discount rate, and for which we can match Barra, Compustat and CRSP data. Out of the 111 questionnaires that include the firm’s identity, five are private firms. For the remaining 106 firms five did not report a discount rate\(^2\), eight have no matching data in Compustat, and for six we cannot attribute a Barra fundamental beta. Finally, we exclude one outlier for our final sample of 86 firms.\(^3\) Similar to previous surveys on corporate finance (Graham and Harvey, 2001; Poterba and Summers, 1995), manufacturing firms are overrepresented in our sample.\(^4\) We then compare these sample firm characteristics with those of the remainder of firms in Compustat and compute \(p\)-values for difference in mean t-tests and Fisher’s exact test for differences in medians under the null hypothesis that they are not different. We also report the summary statistics for the subsample of 73 firms using WACC. In comparison to all other firms in Compustat, the average survey firm is larger in size, measured by book value of assets, market value of assets, or total sales.\(^5\) Whereas the means for book value of assets and sales are not significantly different, the

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\(^2\) A total of eight of the 127 respondents did not provide a discount rate. Six of these firms use other than discounted cash flow (DCF) techniques as their primary capital budgeting technique (three use payback, one return on investment, and two checked “other” as their primary method).

\(^3\) We consider the self-reported discount rate of 40% for one firm to be an outlier. In Appendix C, we repeat the main results of the paper using the sample including this observation. Our findings remain unchanged.

\(^4\) In a number of surveys the fraction of manufacturing firms is even more pronounced. For example, in Gitman and Mercurio (1982) and Gitman and Forrester (1977) manufacturing firms represent 93.8% and 74.0%, respectively.

\(^5\) In a previous version of the paper, we computed market value of assets as total debt plus market value of equity (i.e. total capital) and reported summary statistics for the 93 firms for which we can merge Compustat data. Also, while in the previous version we included only firms in the Compustat sample for which all the items of the main model are available, in this version we report each variable separately and add the number of observations.
medians for all three size measures are significantly different. The market-to-book ratios are comparable, with sample firms exhibiting a smaller mean, but very similar median value. Survey firms also have, on average, a somewhat lower cash-to-book assets ratio. The book assets of survey firms also generate higher operating profits, whereas the median return on equity is comparable. Finally, survey firms are more capital expenditure intensive, although only the difference in medians is significant at the 5% level. Other important financial variables, such as leverage ratio (total debt divided by book value of assets), current ratio, and sales-to-book assets are comparable. The sample statistics for firms using WACC constitute the 74.4% our survey sample and only the median values for the characteristics book assets, market assets and sales are slightly higher than for the sample including all respondents for which we can match data from Compustat data and Barra. All other firm characteristics for this subsample are very similar.

[Insert Table I here]

C. Discount Rates

Given the identity of the survey respondents we compare the firms’ discount rates to their cost of financial capital. Figure 1 plots the discount rates that firms self-report against their cost of financial capital that we compute from beta estimates provided by Barra and Compustat data. Depending on what the firms’ discount rate represents, the horizontal axis measures their WACC, cost of levered equity, or cost of unlevered equity. Firms using some other method to determine their discount rate are compared against their cost of levered equity capital, which represents an upper bound of financial capital. As detailed later in Section V, in this paper we propose a model to explain the discount rates firms use and simultaneously estimate an equity premium of 3.8%, which is almost identical to the number that CFOs report to use in the survey of Graham and Harvey (2005). In Panel A we use this estimate of the equity premium of 3.89% while in Panel B we show the same scatter plot using an equity premium of 7.5%. An equity premium of 7.5% is rather high as the typical project length of the firms in our sample is, on average, 7.3 years (Question 3), i.e. the premium would represent the excess return of equity relative to the risk-free rate of an average maturity of 7.3 years.
The corresponding summary statistics are shown in Table II, Panel A. The mean discount rate that our sample firms use is 15.1% (median 15.0%). The average discount rate of firms using WACC is somewhat lower (14.0%) than the discount rates used by firms for which it represents cost of levered equity (16.7%) and cost of unlevered equity (17.4%). However, the number of firms using the latter two methods is small (3 and 6 firms). The mean discount rate for firms using other methods than WACC, cost of levered equity, and cost of unlevered equity exceeds the mean values for the other categories, however, its median is 15.0% and thus comparable to the other methods. The observation that firms use high discount rates is consistent with Poterba and Summers (1995) who report a mean (median) discount rate of 12.2% (10.0%) in real terms or 17.8% (15.5%) in nominal terms, respectively, for their sample of 228 responding Fortune 1,000 firms. They remark that the average discount rate is “distinctly higher than equity holders’ average rates of return and much higher than the return on debt during the past half-century.”

Table II describes the variation in firms’ discount rates across industry sectors. Despite the substantial variation across firms (see Figure 1), average discount rates vary only moderately from one industry sector to another. The variation between the lowest average discount rate for transportation and communication (12.3%) and the highest for manufacturing (15.8%) of 3.5% is relatively small. Within industry variation is much larger, with firms in the manufacturing sector using discount rates ranging from 7% to 30%.
III. Discount Rates and Cost of Capital

A. Discounted Cash Flow Method

Similar to other recent surveys, we find that firms overwhelmingly use discounted cash flow (DCF) for capital budgeting. We asked the survey participants to select the capital budgeting method they use and in case a firm uses multiple methods, we asked the respondents to identify the two most important ones and rank them. The respondents were given DCF methods (NPV, IRR, APV, and profitability index) and non-DCF methods (payback, discounted payback, return on invested capital, and average rate of return). Of the 127 survey respondents, 87.5% ranked a DCF method as either their first or second choice. The IRR technique is the first choice for 42.1% of the firms, followed closely by NPV (36.5%). For our sample of 86 publicly traded firms which report a discount rate and for which we can match information on fundamental beta and accounting data, the percentage of firms ranking a DCF-method among the two most widely used capital budgeting techniques is even higher at 93.0%. These findings confirm the increased use of DCF-based capital budgeting methods over time as shown in Figure 1. Over the past half-century, the use of DCF capital budgeting methods has increased from less than 15% in 1961 to almost 100% in the very recent surveys. Interestingly, the use of company-wide discount rates has not declined over time.

[Insert Figure 2 here]

B. Modeling Discount Rates

In this section, we model firms’ discount rates as their cost of financial capital and examine whether firms use their cost of financial capital to discount cash flows as prescribed by the standard approach in capital budgeting in the absence of constraints. Our survey asks firms what their discount rate represents (Question 15). Three out of four of our sample firms for which we can match Compustat data (74.4%) respond that their discount rate represents their WACC; i.e., they use their weighted average cost of capital (WACC) to determine their cost of financial capital. This widespread use of WACC is in line with other surveys over the past two decades, as
shown in Figure 2. Bierman (1993), Bruner, Eades, Harris, and Higgins (1998), and Gitman and Vanderberg (2000) report even higher percentages of 89-93% of the firms in their samples of mostly large firms using WACC. Together with the proliferation of DCF methods, the use of WACC has also increased over time. For example, in a survey conducted 40 years ago, Petty, Scott, and Bird (1975) found that only 30% of the Fortune 500 firms that responded to their survey used WACC. Similarly, 46% of the firms in Schall, Sundem, and Geijsbeek (1978) reported using WACC.

For firms responding in our survey that their discount rate represents their WACC, we model the discount rate, $d$, for firm $i$ as WACC, $w_i$, plus a constant, $\pi_0$, and an idiosyncratic error, $\varepsilon_i$.

$$d_i = \pi_0 + w_i + \varepsilon_i,$$

where

$$w_i = \frac{D_i}{D_i + E_i} r_{D,i}(1 - \tau_i) + \frac{E_i}{D_i + E_i} r_{E,i}.$$  

$D_i$ is the book value of debt, $E_i$ is the market value of equity, $\tau_i$ is the before financing marginal tax rate from Graham (1996a, 1996b), and $r_{D,i}$ is the cost of debt imputed from the firm’s estimated credit rating using the model of Jorion, Shi and Zhang (2009). We apply their coefficient estimates to the corresponding accounting and financial variables of our sample firms to estimate a credit score. We then convert these scores in credit ratings based on the estimated values from the ordered probit regression in Jorion et al. (2009). The sample firms’ credit ratings range from AAA to CC. Finally, we use these credit ratings to add the corresponding credit spread to the Treasury bond rate with a maturity that matches the average life of a project from the survey (Question 3). Further details of this procedure are described in Appendix A.


9 See Table 4 in Jorion et al. (2009). The accounting variables are (i) four dummy variables that take the value of one if the interest coverage falls within a certain intervals, defined as in Blume, Lim and MacKinlay (1998), (ii) operating margin, (iii) long-term debt leverage, and (iv) total debt leverage. The financial variables include (v) market size of the firm, (vi) beta from the market model, and (vii) standard error from the market model.
Most firms use the CAPM to estimate their cost of equity capital. Graham and Harvey’s (2001) survey finds that three out of four CFOs use the CAPM. Compared to their sample, the average respondent to our survey is larger, and Graham and Harvey (2001) reason that the use of the CAPM is even more widespread among large firms. From interviews with 27 firms that were elected by their peers for best financial management practices, Bruner et al. (1998) conclude that “the CAPM is the dominant model for estimating the cost of equity.” We therefore follow common practice and compute the cost of equity $r_{E,i}$ using the CAPM

$$r_{E,i} = r_{F,i} + \beta_{MKT,i} \pi_{EP},$$

where $r_{F,i}$ is the Treasury bond rate that matches firm $i$’s average project life, $\beta_{MKT,i}$ is the Barra fundamental beta, and $\pi_{EP}$ denotes the equity premium. We rely on estimates of the firm’s systematic equity risk from Barra because market model regressions for individual firms using past returns tend to produce lower R-squared and noisier estimates of beta. Using the historical beta computed from five years of monthly data or using the Bloomberg shrinkage beta, which puts a weight of two thirds on the historical beta and one third on the CAPM beta of one, yield similar results. We repeat the analysis in this section for those alternative beta estimates and report the results in Appendix C. Graham and Harvey (2001) also find that a small number of firms implements more complex, multi-factor models. Our conclusions do not change when we

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10 The 73.5% of respondents in Graham and Harvey (2001) that always or almost always use the CAPM is in between the 85% reported by Bruner et al. (1998) for their sample of 27 best-practice firms and the 64.9% of Gitman and Vanden Berg (2000; date of survey 1997) for their Fortune 1,000 sample.

11 It is possible that answers to direct questions about using CAPM are biased by the social desirability hypothesis. To avoid such bias, we asked only indirect questions to assess whether survey firms indeed use the CAPM to compute cost of equity. The responses indicate that the use of CAPM is also widespread among our sample of firms. For example, 68.6% of our survey participants check the following statement as being important or very important (Question 14); “market risk of a project, defined as the sensitivity of project returns to economic conditions.” Similarly, a very high proportion of the respondents argued that “interest rate changes” (79.3%) and “changes in stock market returns” (also 79.3%) play important roles in their decision to change their discount rates (Question 12). The responses to the survey questions on the determinants of discount rates are summarized in Appendix B.

12 When limiting our sample to manufacturing firms, regressing reported discount rates from the survey on Barra fundamental betas produces a positive coefficient for beta which is significant at the 10% level, whereas the same relationship using historical beta coefficients (computed from five years of monthly data) is positive but insignificant.
use the Fama and French (1993) 3-factor model or the Chen, Roll, and Ross (1984) macroeconomic factor model instead of the CAPM for estimating the cost of equity capital.

In order to analyze the relation between discount rates and costs of financial capital in a linear regression framework, we substitute equations (2) and (3) into equation (1) and then subtract all components of WACC that are not related to the systematic risk of the firm from both sides of the equation. If firms use WACC as their discount rate, then the self-reported discount rate minus these terms is a function of the firm’s equity beta scaled by the weight of equity:

\[
\tilde{d}_i = \frac{D_i}{D_i + E_i} r_{D,i} (1 - \tau_i) - \frac{E_i}{D_i + E_i} r_{F,i} = \pi_0 + \frac{E_i}{D_i + E_i} \beta_{MKT,i} \pi_{EP} + \varepsilon_i. \quad (4)
\]

We refer to the expression to the left of the equals sign in equation (4) as the adjusted discount rate for firm \(i\), \(\tilde{d}_i\), where

\[
\tilde{d}_i = d_i - \frac{D_i}{D_i + E_i} r_{D,i} (1 - \tau_i) - \frac{E_i}{D_i + E_i} r_{F,i}. \quad (5)
\]

In order to simplify the notation further, we denote the scaled CAPM beta as \(\tilde{\beta}_{MKT,i}\), where

\[
\tilde{\beta}_{MKT,i} = \frac{E_i}{D_i + E_i} \beta_{MKT,i}. \quad (6)
\]

For firms reporting that they use WACC to compute their cost of capital, we then regress the firms’ adjusted discount rates on a constant, \(\pi_0\), and \(\tilde{\beta}_{MKT,i}\):

\[
\tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{MKT,i} + \varepsilon_i. \quad (7)
\]

The coefficient estimate \(\tilde{\pi}_{EP}\) is an estimate of the equity risk premium that managers use when applying CAPM and \(\varepsilon_i\) is an idiosyncratic error term. If our model is correctly specified, we expect our equity risk premium estimate to be close to the value managers use in computing their discount rates. Graham and Harvey (2005) report that CFOs used an average equity risk premium of 3.8% at the time of our survey, and the intercept should be zero.
Column (1) in Table III reports the regression results for the 64 firms that report using WACC to compute their cost of capital. The estimate for $\pi_{EP}$ is 5.2% and highly statistically significant, suggesting that adjusted discount rates are indeed related to firms’ CAPM beta. Nevertheless, these results suggest that WACC is only a part of the discount rates that firms use for capital budgeting. Compared to the 3.8% reported by Graham and Harvey (2005), this estimate for the equity risk premium is relatively high. Additionally, the intercept indicates that firms use discount rates that, on average, exceed their cost of capital by 5.6 percentage points. Given that the mean discount rate of the 64 firms that use WACC to compute their cost of capital is 14.8%, about one third of the discount rate for an average firm cannot be explained by its cost of capital. The modest value of 0.20 for the adjusted R-squared also suggests that cost of capital is only one dimension of firms’ discount rates.

[Insert Table III here]

Next, we add the six firms that indicate in the survey that they use their unlevered cost of equity as their discount rate. These six firms presumably use an Adjusted Present Value (APV) approach, where tax savings from debt financing are considered separately and thus do not affect their discount rate, unlike for WACC. For these firms, therefore, we define their adjusted discount rate as

$$\tilde{d}_i = d_i - \frac{D_i}{D_i + E_i} r_{D,i} - \frac{E_i}{D_i + E_i} r_{F,i}$$

and $\tilde{\beta}_{MKT,i}$ as in equation (5). After including these firms, the results, which are reported in column (2) of Table III, are very similar to those in column (1).

Next, we further add the three firms that use their levered cost of equity as their cost of capital. For these firms, the self-reported discount rate from the survey corresponds to $r_E$ and, therefore, we only need to subtract the risk-free rate to obtain the adjusted discount rate,

$$\tilde{d}_i = d_i - r_{F,i},$$

and the variable $\tilde{\beta}_{MKT,i}$ is equal to beta, without multiplying by the ratio of equity-to-total capital,
\[
\tilde{\beta}_{MKT,i} = \beta_{MKT,i} \, .
\] (10)

The results after including these firms are reported in column (3). Finally, we include firms that indicate that their hurdle rate represents something else. We introduce an indicator variable \( OTHER_i \) that takes the value one for these “other” firms (and zero otherwise), and set \( \tilde{\beta}_{MKT,i} = 0 \). We then estimate the following linear regression:

\[
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OTHER}OTHER_i + \varepsilon_i \, .
\] (11)

The results, which are now estimated on the full sample, are reported in column (4). The average discount rate for these firms using other methods than WACC, cost of levered equity, or cost of unlevered equity is \( 0.550 + 0.1340 = 18.9\% \).

In all four models, the estimated equity risk premium, \( \hat{\pi}_{EP} \), is somewhat higher than the 3.8\% found in Graham and Harvey’s (2005) survey. This difference suggests that there might be omitted variables that are correlated with the residuals—an issue that we return to address below. However, our regression results show that discount rates used in practice are related to firm’s systematic risk. The results in Table III are robust to different estimations of beta coefficients and marginal tax rates, as shown in Appendix B.\textsuperscript{13}

**C. Do Firms Use WACC or Just Its Components?**

As summarized in equation (2), a firm’s WACC is a nonlinear function of its financial leverage, its required returns on debt and equity, and its corporate tax rate. In this subsection, we examine whether a linear model of these underlying components, including a firm’s equity beta, can better explain the firm’s discount rate than does WACC itself.

\textsuperscript{13} In our computations of WACC we use the Barra fundamental beta. Table B.I in the appendix shows that using historical betas estimated from regressions of monthly data over five years on S&P 500 index returns instead of the Barra fundamental betas, or using the Bloomberg shrinkage betas, results in slightly lower adjusted R-squares than reported in Table III. For the full sample in column (4), the adjusted R-square decreases from 0.424 to 0.346 and 0.381, respectively. The adjusted R-squares assuming a 0\% or 34\% tax rate, or using the firm’s average tax rate, are comparable.
In this analysis, we focus on the 64 firms that use WACC as their discount rate and directly regress firms’ stated discount rates, $d_i$, (not the adjusted discount rates, $\hat{d}_i$, that we analyze elsewhere), on the components of WACC. The results are reported in Table IV. If firms use the CAPM along with WACC to determine their discount rates, then the discount rates should be linked to firms’ CAPM betas. To test for this relationship, we examine firms’ fundamental beta, provided by Barra, as the single explanatory variable. The coefficient estimate in column (1) reveals the discount rates to be positively related to fundamental betas; however, the coefficient is insignificant and the R-squared is very low, indicating that beta alone cannot explain discount rates. This finding is consistent with Poterba and Summers (1995).

This univariate regression does not account for the other components of cost of financial capital, such as the firms’ cost of debt, and does not consider that firms differ in their capital structure. Therefore, we regress self-reported discount rates on the firms’ before-tax cost of debt, marginal tax rate, debt-to-asset ratio, and two components of the CAPM, the risk-free rate and the Barra fundamental beta. As before, the debt rate $r_{D,i}$ is imputed from the firms’ predicted debt rating and $\tau_i$ is the before-debt measure from Graham (1996a, 1996b). The risk-free rate $r_{F,i}$ is obtained from the prevailing term structure of Treasury rates after matching the average life of a firm’s projects as indicated in the survey.

As reported in Column (2), estimating a linear relationship between discount rates and the various components of WACC yields a negative adjusted R-squared. None of the various WACC components is significantly related to firms’ discount rates. The coefficient on CAPM beta is again positive and statistically insignificant. Cost of debt is positively related with discount rates, however, its standard error is relatively high, and the ratio debt-to-total capital is negatively related to discount rates. As we will discuss later, this negative relationship is consistent with the notion that firms with more financial flexibility (i.e., firms with low debt ratios and high cash balances) tend to use higher discount rates.

Another way to distinguish between the contribution of the compensation for equity risk and the other WACC variables is to regress discount rates on the following two components of WACC: one related to beta and the other representing the remainder related to the firm’s debt rate and the risk-free rate. Specifically, we estimate the following specification:
\[ d_i = \pi_0 + \pi_{EP} \bar{\beta}_{MKT,i} + \pi_\theta \bar{w}_i + \epsilon_i, \quad (12) \]

where

\[ \bar{\beta}_{MKT,i} = \frac{E_i}{D_i + E_i} \beta_{MKT,i} \quad (13) \]

and

\[ \bar{w}_i = \frac{D_i}{D_i + E_i} r_{D,i}(1 - \tau) + \frac{E_i}{D_i + E_i} r_{F,i}. \quad (14) \]

The term \( \bar{w}_i \) corresponds to the part of WACC that we deducted previously from the self-reported discount rate to compute adjusted discount rates. It combines all the terms that are not directly related to the compensation for equity risk. If the model is correctly specified, the coefficient estimate \( \pi_{\theta} \) provides an estimate of the equity premium, and the coefficient estimate \( \pi_\theta \) is expected to be one. \( \pi_0 \) is a constant, and \( \epsilon_i \) is the error term.

As reported in column (3), both components of WACC are positively related to discount rates. The estimated equity premium is 2.6% and is statistically significant at the 10% level. Its value is low even when compared to the 3.8% value from Graham and Harvey (2005). The relatively low estimate of the equity premium in column (3) may result from an omitted variable bias, a possibility that we explore below. The increase in adjusted R-squared from –0.015 in column (2) to 0.048 in column (3) shows that the non-linear dependence on the different WACC components is important. However, as before, the cost of financial capital alone cannot explain much of the variation in discount rates. In the final specification, \( \bar{\pi}_{\bar{w}} \) equals 0.0269 with a standard error of 0.0270, so we can clearly reject the hypothesis that \( \pi_{\bar{w}} \) is equal to one. This provides another indication that there are variables missing from the model.\(^{14}\) We investigate these missing variables in Section IV below.

\(^{14}\) Another way to interpret the specification in column (3) of Table IV is modeling the discount rate as a linear function of WACC: \( d_i = \alpha_0 + \alpha_3 WACC_i + \epsilon_i \), i.e., \( d_i = \alpha_0 + \alpha_1 \pi_{EP} \bar{\beta}_{MKT,i} + \alpha_3 \bar{w}_i + \epsilon_i \). It follows from the estimates reported in column (3) of Table VI that \( 0.0264 = \bar{\alpha}_1 \pi_{EP} \) and \( 0.0269 = \bar{\alpha}_3 \), i.e., that the equity premium is \( \bar{\pi}_{EP} = \frac{0.0264}{0.0269} = 0.9814 \), which is almost 100%. The data thus clearly
The question arises whether the adjusted R-squared of 4.8% in column (3) of Table IV is just noise or whether the discount rates firms use are positively related to their systematic risk measures. To answer this question we conduct the following Monte Carlo simulation. For each firm we assign a debt-equity-ratio (and thus the two weights in the WACC equation), a cost of debt, and a tax rate that are randomly drawn from the sample. Then we re-estimate equation (12) and compute the probability that we would observe an adjusted R-squared of 0.048. We find that there is only a 4.4% probability that, when assigning randomly the WACC components other than beta, the adjusted R-squared would attain 0.048. Hence, despite the relatively small increase in the adjusted R-squared, our finding of a positive relation between discount rate and systematic risk of a firm (i.e., $\hat{\beta}_{MKT,i}$) in the cross-section is unlikely to be due to chance alone.

That the relation between $d_i$ and $\beta_{MKT,i}$ is not statistically significant whereas the relation between $d_i$ and $\hat{\beta}_{MKT,i}$ supports the firms’ response that they indeed use WACC in determining their discount rates. By regressing adjusted discount rates on scaled CAPM betas, our specification takes into account the non-linear dependence of the cost of capital as a function of leverage and systematic risk, $\beta_{MKT,i}$. It may explain why Poterba and Summers (1995), who regress firm’s raw discount rates on their unscaled CAPM betas, came to the conclusion that discount rates in practice are unrelated to beta and at the same time three out of four CFOs tell Graham and Harvey (2001) that they use CAPM in determining their cost of equity. For the remainder of the analysis, we therefore assume that firms use WACC and thus analyze the adjusted discount rate as the dependent variable.

D. Do Firms Use Other Models for Their Cost of Equity Capital?

The analysis presented so far suggests that, while firms’ discount rates are related to their WACC, they are not fully explained by WACC or its components. Next, we investigate whether the difference comes from firms using other models instead of the CAPM to estimate their cost of equity capital. In particular, we consider each of the following: the Fama and French (1992) 3-
factor model, which includes additional factors to capture the size effect (SMB) and the value effect (HML); additional factors that take into account exposure to inflation risk, currency risk, and idiosyncratic risk; and the Chen, Roll and Ross (1986) model, which uses macro-economic factors to capture exposure to business cycle risk.

Table V reports the results from analysis that uses various sets of multifactor models for firms’ cost of equity. We compare each multifactor model to the baseline model where firms estimate their cost of equity directly from CAPM (see Table III, column 4). To facilitate comparison, we repeat result from the baseline CAPM model in column (1) of Table V. Adjusted R-squared in the baseline model is 0.411.  

The dependent variable in all regressions is the adjusted discount rate as in Table III.

In the specification reported in column (2) of Table V, we specify the cost of equity using a Fama and French (1992) 3-factor model in place of the CAPM in equation (3). Specifically, we estimate:

\[
\hat{d}_i = \pi_0 + \pi_{EF}\hat{\beta}_{MKT,i} + \pi_{SMB}\hat{\beta}_{SMB,i} + \pi_{HML}\hat{\beta}_{HML,i} + \pi_{OTHER}\hat{OTHER}_i + \epsilon_i. \tag{16}
\]

This specification is the same as in equation (11) but for the two additional risk factors. As before, \(\hat{OTHER}_i\) is an indicator variable for the firm using any method other than WACC, the cost of unlevered equity, or the cost of levered equity. The factors \(\hat{\beta}_{SMB,i}\) and \(\hat{\beta}_{HML,i}\) are defined analogous to \(\hat{\beta}_{MKT,i}\) (see equation 13), where the Barra fundamental beta, \(\beta_{MKT,i}\), is replaced by \(\beta_{SMB,i}\) and \(\beta_{HML,i}\), respectively:

\[
\hat{\beta}_{SMB,i} = \frac{E_i}{D_i + E_i} \beta_{SMB,i} \quad \text{and} \quad \hat{\beta}_{HML,i} = \frac{E_i}{D_i + E_i} \beta_{HML,i}. \tag{17}
\]

We use five years of monthly data preceding the survey date to estimate the factor loadings for size and book-to-market. The two factor loadings \(\beta_{SMB,i}\) and \(\beta_{HML,i}\) are calculated as follows. First, we subtract each month the product of the CAPM beta and the market return from the firm’s excess return,

\[
r_{i,t}^* = (r_{i,t} - r_{F,t}) - \beta_{MKT,i}r_{M,t}.
\]

Second, using returns from Kenneth

\[15\] The R-squares are not comparable to Table IV because of the different dependent variable.
French’s web site, we regress excess returns, \( r_{i,t}^* \), on the returns of the factor-mimicking portfolio \( SMB \) and \( HML \) to get estimates for \( \beta_{SMB,i} \) and \( \beta_{HML,i} \).

The estimates from equation (16) are reported in column (2) of Table V. As in our previous analysis, the equity risk premium is relatively high. When the cost of equity is modeled by the Fama-French 3-factor model, the adjusted R-squared from regressing adjusted discount rates on the three risk factors decreases compared to column (1); from 0.411 to 0.402. Hence, the two factors do not improve the explanatory power. This finding accords with survey results from Graham and Harvey (2001), which document that CFOs rarely use multifactor models to develop a discount rate for capital budgeting. When asked specifically about the importance of size and market-to-book ratio (and momentum), managers do not rank these risk factors among the most relevant ones for adjusting discount rates or cash flows. In their survey, among the eleven multi-beta risks, momentum ranked last (considered as important by 11.1% of the respondents), market-to-book ratio ranked second-to-last (13.1%), and size ranked sixth (34.0%). In Table V, the point estimate for book-to-market, while statistically insignificant, is even negative, which is opposite the sign the model predicts. This evidence supports the view that the Fama-French 3-factor model is not yet used widely for capital budgeting.

Unexpected changes in interest rates and the equity premium affect the time value of future cash flows and ultimately the return on investment. Grauer, Litzenberger, and Stehle (1976) and Adler and Dumas (1983) propose models where inflation risk is priced as investors use part of their portfolio to hedge against domestic inflation risk. They expect the price of inflation risk to be negative so that assets whose returns are high in times of high inflation earn lower expected returns. Ferson and Harvey (1991) argue that the premium for inflation risk could be positive if inflation has negative real effects and firms differ in their exposure to changes in inflation. Chen, Roll, and Ross (1986) find weak evidence that measures of unanticipated inflation and changes in expected inflation are priced in size-sorted portfolios during periods when these variables are volatile. Using the Grauer, Litzenberger, and Stehle (1976), Adler and Dumas (1983), and Solnik

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\textsuperscript{16} Grauer et al. (1976) assume that purchasing power parity holds and all country inflation rates collapse to a single inflation rate. In contrast, in Adler and Dumas (1983) inflation risk is potentially priced differently in each country. See e.g. Dumas (1994) and Stulz (1995) for a literature overview on international asset pricing.
In analysis reported in column (3), we test whether inflation risk can explain the variation in the discount rates firms use for capital budgeting. Similar to the factor loadings for SMB and HML, we compute the inflation beta by regressing the excess returns \( r_{it}^{*} \) on an inflation index. Discount rates that are positively related to inflation provide a hedge against inflation risk. Therefore, we would expect a negative coefficient for the inflation risk premium. The estimated coefficient for inflation risk, however, is positive and statistically significant at the 5%, suggesting that the inflation variable may be proxying for other (omitted) economy-wide risk factors.\(^{17}\) Although the coefficient is statistically significant, the adjusted R-squared increases only slightly from the baseline 0.411 to 0.431.

Next, we consider exchange rate risk. Dumas and Solnik (1995) estimate a conditional International CAPM (ICAPM) and find evidence that exchange rate risk is priced in major stock markets, including the U.S., U.K., Germany, and Japan. This finding is further supported by the results in De Santis and Gérard (1998) and Doukas, Hall, and Lang (1999). Vassalou (2000) reports evidence that both exchange rate and foreign inflation risk factors capture some of the within-country cross-sectional variation in returns. Relaxing the assumption of the Adler and Dumas (1983) ICAPM that inflation rates are constant, Moerman, Mathijs, and van Dijk (2010) confirm the existence of exchange rate risk premiums in international asset returns.

In analysis reported in column (4), we test whether exchange rate risk can explain the variation in the discount rates firms use for capital budgeting. To assess a firm’s exchange rate risk sensitivity, we first regress the excess returns \( r_{it}^{*} \) on the U.S. dollar-Yen exchange rate.\(^{18}\) We then

\(^{17}\) Indeed, the estimated inflation risk premium is much smaller and statistically significant if we also control for the firms’ sensitivity to industrial production, \( \tilde{\beta}_{MP,t} \), discussed below.

\(^{18}\) Not only is it difficult to determine which currency pair is most relevant for the cash flows of our sample firms, but we also do not have information on the degree of hedging and thus a firm’s net currency risk exposure.
include this sensitivity in our model for firms’ adjusted discount rate. We find that currency risk is not priced in capital budgeting, as the coefficient in column (4) is small and not statistically different from zero. This result may not be surprising as the majority of empirical studies, including Jorion (1990), Choi and Prasad (1995), and Griffin and Stulz (2001), find only weak evidence of currency exposure for U.S. firms, even when analyzing multinationals. Bartram (2008) provides a clinical study of a large nonfinancial multinational firm and documents that its residual foreign exchange rate exposure is small.

Next, we test whether the macroeconomic risk factors have a significant impact on firm’s discount rates. Indeed, the CFOs surveyed by Graham and Harvey (2001) stress the importance of interest rate and business cycle risk for capital budgeting. Following Chen, Roll, and Ross (1986), we include a firm’s exposure to industrial production growth, unexpected and expected changes in inflation, unanticipated changes in the term structure, and unanticipated changes in the credit risk premium. As before, we compute the sensitivities by regressing five years of monthly excess returns on monthly data for each of these five macroeconomic variables.

The results are reported in column (5) of Table V. While the risk premium, $\hat{\pi}_{MP}$, for the firms’ sensitivity to the growth rate of industrial production, $\hat{\beta}_{MP,i}$, is statistically significantly negative at the 5% level, contrary to what we should expect based on economic theory, suggesting possible model misspecification. When we replace in column (5) the unanticipated inflation beta, $\hat{\beta}_{UI,i}$, with the inflation beta from column (3), $\hat{\beta}_{INFL,i}$, its coefficient becomes insignificant ($\pi_{INFL} = 0.106$, with a standard error of 0.300). This suggests that inflation proxies for the business cycle, and the significance of the inflation beta disappears once we include a macro variable for economic growth.

Finally, we investigate whether firms’ discount rates reflect firms’ idiosyncratic, in addition to their systematic, risk. An extensive literature argues that idiosyncratic risk is priced. Merton (1987) introduces a model where investors are under-diversified and as a consequence idiosyncratic risk and expected returns are positively related. Goetzmann and Kumar (2008) document that a large fraction of households indeed hold poorly diversified portfolios and Fu (2009) shows that the standard deviation of monthly idiosyncratic risk is higher than for most other firm characteristics. Using an exponential generalized autoregressive conditional
heteroskedasticity (EGARCH) model to capture the time variation, Fu (2009) finds a significantly positive relation between the estimated conditional idiosyncratic risk levels and expected return in the U.S. and Brockman and Schutte (2009) find the same internationally. Managers’ career concerns might also lead to an aversion to idiosyncratic risk in capital budgeting.

In analysis reported in column (6), we add idiosyncratic risk, \( IDIO_i \), to the baseline model. This variable is calculated as one minus the R-squared from the market index model regression for stock \( i \) over the past five years using monthly data. Consistent with these studies, we find that the coefficient for idiosyncratic risk is significant at the 1% level and the adjusted R-squared increases to 0.458. As can be seen from column (5) and (6), the adjusted R-squared for the model with CAPM and idiosyncratic risk is higher than for the Chen, Roll, and Ross (1986) multifactor specification.

In sum, we find that, in line with results from previous surveys, firms in our sample do not use multifactor models to calculate cost of equity. Firms that are more sensitive to economic growth tend to use lower discount rates. Most importantly, we find that idiosyncratic risk matters and the question that arises from this result is whether idiosyncratic risk proxies for some other firm-specific risk factors.

IV. Why Do Firms Use Discount Rates Above their Cost of Capital?

Given the above analysis, part of firms’ discount rates appears to be determined by something other than their cost of financial capital. In this section, we evaluate various hypotheses—including managerial optimism, managerial short-termism, financial constraints, and managerial constraints—to explain why firms evaluate projects using discount rates that are substantially higher than their cost of financial capital.

While Ang, Hodrick, Xing, and Zhang (2006) find that idiosyncratic risk in one month predicts very low returns over the subsequent month, Bali and Cakici (2008) invoke the data frequency to estimate idiosyncratic volatility and methodological issues (weighting schemes to compute average portfolio returns, breakpoints to sort stocks into idiosyncratic risk quintile portfolios, screening for size, price, and liquidity).
A. Managerial Optimism

One possibility is that managers use high discount rates to guard against overly optimistic cash flow forecasts. Heaton (2002) develops a model where optimistic managers overstate their cash flow forecasts even if they act in the interest of shareholders. Managers may overstate projected cash flows due to optimism or may strategically report inflated numbers to attract more funding and have their division grow (i.e., empire building).

This hypothesis does not resonate with most managers. In our survey, only 9.5% of the respondents strongly agree that they adjust their discount rate upward to account for optimism in cash flow forecasts (Question 20a). Indeed, on a scale from $-2$ (strongly disagree) to $+2$ (strongly agree), the mean is 0.047 with a standard deviation of 1.174. To examine if managerial optimism can explain adjusted discount rates, we add an indicator variable, $OPTI_i$, which takes the value of one when firms “agree” or “strongly agree” and zero otherwise, to our baseline regression. Specifically, we estimate the following specification:

$$
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OPTI}OPTI_i + \pi_{OTHER}OTHER_i + \epsilon_i.
$$

As reported in column (1) of Table VI, the firms that express some concern about managerial optimism in the survey do not actually use larger discount rates. The estimated coefficient $\hat{\pi}_{OPTI}$ is negative and statistically insignificant. In comparison to the baseline specification, reported in column (4) of Table III, which models discount rates as a function of the cost of financial capital alone, the adjusted R-squared decreases slightly from 0.411 to 0.403.

To corroborate our survey finding, we also examine discount rates’ relation with four measures that we construct from Compustat of the potential for cash flows to be overstated. These measures are motivated by the studies of Rajan, Servaes, and Zingales (2000), Stein (2002), McNeil and Smythe (2009), and Xuan (2009). Xuan (2009) finds that divisions with which the CEO has not previously affiliated receive significantly more capital expenditures than divisions through which the new CEO has advanced. Within a firm with more business segments there is a higher competition among divisional managers to attract funding for their projects. At the same time it is more difficult to monitor projects. This creates incentives to report optimistic cash flow forecasts. Thus, one might expect that managers of firms with more business segments would use
higher discount rates to guard against inflated cash flow forecasts from divisional managers. We test whether discount rates are related to the number of business segments using either a continuous measure (reported in column 2) or indicator variables for 4–10 and more than ten business segments (column 3).

Similarly, one might argue that internal capital markets are more prone to empire-building behavior within diversified firms. Firms that are more diversified tend to be more decentralized, so there is often a greater scope for reporting inflated divisional cash flow forecasts to compete for funding. We use the Herfindahl index to measure the degree of business concentration (column 4). A higher value of the Herfindahl index identifies a less diversified firm, so if managers adjust for optimism, we would expect this variable to be negatively related to discount rates. Finally, we consider the natural logarithm of firm size (column 5). Irrespective of the number of divisions, competition for funding may be greater in large firms than in small firms, in which case managers might be more likely to confront inflated divisional cash flow projections at larger firms and we would expect a positive coefficient when regressing discount rates on firm size.

Columns (2) through (5) of Table VI summarize the results for these four predictors of firms’ exposure to optimistic cash flow forecasts. In all four specifications, the coefficients are close to zero. In three of the four specifications, the adjusted R-squared is lower than in the baseline model (0.411; column 4 of Table III), and only 0.03 higher in the fourth specification, where the coefficient is practically zero, precisely estimated, and has the opposite sign of what we predicted. These results support the finding based on survey data that most firms do not systematically add a premium to their cost of financial capital to account for optimistic cash flows.

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20 The Herfindahl index is calculated as the sum of the squares of market shares of each business segment of the firm using net sales.
B. Managerial Short-Termism

Another possible explanation is that myopic managers may have a preference for cash flows that occur earlier. By using discount rates exceeding the cost of financial capital when taking investment decisions, managers forgo profitable long-term investment opportunities that reduce current expenditures and thus increase current earnings. Indeed, Stein (1989) shows that such myopic corporate behavior can persist even though the market is not fooled in equilibrium. Graham, Harvey, and Rajgopal’s (2005) survey of CFOs provides support for myopic corporate behavior. They find that the majority of managers in publicly traded corporations would avoid taking a positive NPV project if it would entail falling short of the current quarter’s consensus earnings forecast.

We use three different measures to capture a firm’s propensity to adopt myopic behavior when taking investment decisions. First, we compute for each firm its market share within the 2-digit SIC industry the firm belongs to. We expect that firms with a substantial market share would not feel pressured to signal their value by reporting promising earnings. We therefore add the market share within the two-digit SIC industry, $MKTSHARE_i$, to our baseline model:

$$\tilde{d}_i = \pi_0 + \pi_{EP}\beta_{MKT,i} + \pi_{MKTSHARE}MKTSHARE_i + \pi_{OTHER}OTHER_i + \epsilon_i.$$  (19)

Column (1) of Table VII shows that the coefficient estimate for this variable is insignificant. Alternatively, we define a Herfindahl index that measures concentration within the firm’s two-digit SIC industry, $INDHII_i$. We expect firms in less concentrated and more competitive industries to be more subject to managerial myopia as described in the model in Stein (1989). The coefficient estimate in column (2) has the expected sign, but remains insignificant.

A manager’s incentive for short-term behavior is exacerbated when the firm’s share price reacts sharply to earnings news. Higher stock prices may make the manager’s job more secure and result in higher take home pay when compensation is tied to the firm’s stock price or when he or she owns company stock. Asker, Farre-Mensa, and Ljungqvist (2013) use the earnings response coefficient (ERC) of Ball and Brown (1968), estimated separately for each industry as in Easton
and Zmijewski (1989), as a measure for the investment sensitivity of a given industry.\textsuperscript{21} However, the coefficient estimate reported in column (3) of Table VII is negative and insignificant.

\textbf{C. Financial Constraints, Managerial Constraints, and Financial Flexibility}

Because risk factors, adjustments for managerial optimism, and managerial short-termism cannot explain why firms’ discount rates exceed their cost of financial capital, we conclude that firms must face some sort of constraint.

One classic explanation of why firms would forego a positive NPV project is that projects may be mutually exclusive—i.e. taking one project prevents taking other projects. That may be due to financial constraints. Following Myer’s (1977) seminal work, it is well recognized in the literature that the presence of risky debt in the capital structure can lead to rejecting positive NPV projects and the inability to finance new investments due to debt overhang. Hennessy (2004) finds empirical support for the presence of debt overhang problems in the data.\textsuperscript{22}

We evaluate to what extent financial constraints can explain the high discount rates firms use in capital budgeting. Our questionnaire asks respondents whether they agree, on a scale from $-2$ (strongly disagree) to $+2$ (strongly agree), with the statement: “there are some good projects we cannot take due to limited access to capital markets” (Question 20c). The mean response to this question is $-0.212$ with a standard deviation of 1.440. Although firms, on average, do not consider themselves to be financially constrained, there is considerable dispersion. About 14.1% strongly agree that they forgo positive NPV projects because of financial constraints and another 24.7% somewhat agree. We define an indicator variable, $FINC_i$, for these firms and test whether they use higher discount rates in capital budgeting. Specifically, we estimate the following specification:

\textsuperscript{21} We thank Alexander Ljungqvist for sharing the ERC measure.

\textsuperscript{22} There is an ongoing debate regarding the magnitude of the cost imposed by debt overhang. See Mello and Parsons (1992), Parrino and Weisbach (1999), Titman and Tsyplakov (2003), and Moyen (2007) among others.
\[ \bar{d}_i = \pi_0 + \pi_{EP}\tilde{\bar{\beta}}_{MKT,i} + \pi_{FINC}FINC_i + \pi_{OTHER}OTHER_i + \varepsilon_i. \] (20)

The results, reported in column (1) of Table VIII, show no evidence of financial constrained firms using higher discount rates. Indeed, the point estimate is negative but not statistically significantly.

As before, we further corroborate the result based on survey answers with variables constructed from balance sheet data. To this end we use four established measures of financial constraints to verify our survey finding. We use the following four measures of financial constraints: Altman’s Z-score, current ratio, debt-to-equity ratio and the Kaplan-Zingales index as computed in Lamont, Polk, and Saá-Requejo (2001).

In column (2) of Table VIII we use an indicator variable for unconstrained firms, and zero for constrained firms based on their Altman Z-score. If financial constraints explain the use of higher discount rates we would expect the coefficient from regressing discount rates on this measure to be negative. Firms with a high current ratio are not facing financial constraints and we would also expect to find a negative relation with firms’ discount rates. The inverse is true for the debt-to-equity ratio where firms with high debt levels are more likely to face financial constraints. The Kaplan-Zingales index quantifies the degree of financial constraints and higher values indicate that the firm is more financially constraint. Consequently, we would expect a positive relationship with discount rates if financial constraints explain the use of high discount rates.

Table VIII shows the results of the effect of financial constraints on discount rates. All four Compustat-based measures are statistically significant, however, point in the other direction. It appears that firms that are subject to financial constraints use lower discount rates, in contrast to what we would expect if capital constraints explain why firms add a premium to their cost of capital in evaluating projects. Thus, the previous finding based on the survey responses regarding financial constraints, holds when using commonly used proxies to identify financially constrained firms.

Almeida, Campello, and Weisbach (2004) report that financially constrained firms with limited access to external capital hold larger cash balances than unconstrained firms. Faulkender and
Wang (2006), Pinkowitz, Stulz, and Williamson (2006), and Denis and Sibilkov (2010) support this view that cash holdings are more valuable for constrained firms than for unconstrained firms.

Firms holding large cash positions may be doing so due to financial constraints or for managerial constraints that make raising funds for new projects costly and time consuming. McDonald (1999) and Jagannathan and Meier (2002) argue that firms with limited managerial or organizational capital may not be able to take every positive NPV project that is currently available to them if the managers expect to get even better investment opportunities in the future. Such firms screen their investment opportunities using discount rates that exceed their cost of capital. Furthermore, holding cash assures that they have financial flexibility to exploit their growth options that they can finance at short notice without incurring excessive costs. Simutin (2010) shows that firms with high cash balances invest more in the future. He interprets this evidence as consistent with excess cash holdings being a proxy for risky growth options, consistent with Jagannathan and Meier (2002). Based on their structural model, Asvanunt, Broadie, and Sundaresan (2011) conclude that future investment and growth options may provide a strong motive for accumulating cash balances. For a sample of firms in EMU countries, Ferreira and Vilela (2004) observe that firms with richer investment opportunities, and firms with high cash flows, exhibit higher cash holdings. While there may be a variety of possible reasons why firms hoard cash, holding cash provides financial flexibility. We use the ratio of cash to total assets as a measure of financial flexibility.

There is some support for the view that managerial constraints are more important from our survey responses. More than half of our survey respondents “agree” (40.0%) or “strongly agree” (15.3%) with the statement that “we cannot take all profitable projects due to limited resources in

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23 A similar strand of literature examines firms that retain financial flexibility by adopting a conservative leverage policy. The model of DeAngelo, DeAngelo, and Whited (2011) predicts that ex ante optimal financial policies preserve financial flexibility to access in the event of a shock to investment opportunities or an unexpected shortfall of earnings. In support of this prediction, Marchica and Mura (2010) find that their U.K. sample firms pursuing a low-leverage policy spend more on capital expenditures once they abandon their low-leverage policy and use their financial flexibility they built up. DeJong, Verbeek, and Verwijmeren (2012) substantiate their conclusion for U.S. firms.

the form of limited qualified management and manpower.” The mean response is 0.353 with a standard deviation of 1.202. A t-test confirms that the difference of 0.565 compared to the -0.212 for the question on financial constraints is significantly different at the 1% level. Thus, survey respondents consider managerial constraints to be more important for investment decisions than financial constraints.25

To further explore the role of managerial and organizational constraints, we construct an indicator variable, which takes the value of one when the responding firm agrees or strongly agrees with our statement on managerial constraints, and zero otherwise. Adding this variable to our baseline specification (from column (4) of Table III), which models discount rates as a function of WACC, confirms our hypothesis that managerially constrained firms use higher discount rates. Column (1) of Table IX shows the results with a positive, although insignificant, coefficient for the managerial constraints variable. We then add our financial flexibility measure separately. If financial flexibility is important, one would expect a positive coefficient for cash holdings, i.e. firms with high cash holdings would use high discount rates. When firms that hold more cash are in poor financial health and are unlikely to have a large collection of attractive positive NPV projects, we would expect the coefficient to be negative. Column (2) shows that including cash-to-assets increases the R-squared of the model to 0.494 and the coefficient is significantly positive at the 1% level.26 In specification (3) we incorporate both, financial and managerial constraints.27 Controlling for financial flexibility measured by the cash-to-asset ratio, the coefficient on the managerial constraints indicator variable is significantly positive, supporting the hypothesis that firms with limited qualified manpower use higher discount rates. At the same time, the survey variable for financial constraints becomes significantly negative. The positive coefficient for cash is consistent with the view that managerially constrained firms

25 When asked about the important factors affecting the firm’s debt policy, the CFOs responding to Graham and Harvey’s (2001) survey rank financial flexibility highest.

26 Financial flexibility can be in the form of unused debt capacity and low debt ratios and/or high cash balances. In unreported results, we find that adding the debt-to-assets ratio to model (2) indeed further increases the adjusted R-squared to 0.544. However, at the same time the coefficient for \( \beta_{MKT,i} \) decreases (0.0209), because this variable is merely a scaled by the debt-to-asset ratio.

27 At the same time managerially constrained firms can also be financially constrained. Consequently, managerially constrained firms would use higher discount rates. In fact, the Spearman correlation coefficient between the survey answers on managerial and financial constraints is 0.501.
hoard cash to exploit their growth options. Moreover, it affirms that holding cash to retain financial flexibility dominates the precautionary motive of financially constrained firms. Taken together, these results suggest that financial flexibility as a proxy for growth options and capturing operational constraints are two important omitted variables.

D. Putting it all together

Based on the analysis in the previous section, we build our model to explain firms’ discount rates. Our initial analysis suggests that managers use the CAPM to compute their cost of equity. Furthermore, it appears that firms tend to increase their discount rates to account for idiosyncratic risk. We then add for each of the hypotheses we explored in the current Section IV, the one measure that produced the best fit, thereby augmenting the model for discount rates that firms use. We examine potential model misspecification by examining whether the inferred equity premium and the coefficient for the non-equity part of WACC are closer to our expectation of 3.8% from the survey of Graham and Harvey (2005) and closer to one, respectively. Such a finding would indicate that our specification has fewer omitted variables.

Regarding the choice of the four measures of financial constraints using accounting data we retain Altman’s Z-score. While none of the measures of an adjustment for optimistic forecasts was significant individually, we include both, the survey measure and one Compustat based measure, the concentration of business segments within the firm (\(\pi_{\text{HERF}}\)), in order to verify that after controlling for the other omitted variables the coefficients for these explanatory variables do not show up significantly.

We therefore consider the following full model of the cross section of discount rates across firms.

\[
\tilde{d}_i = \pi_0 + \pi_{\text{EP}} \beta_{\text{MKT},i} + \pi_{\text{OTHER}} \text{OTHER}_i + \pi_{\text{IDO}} \text{IDO}_i + \pi_{\text{FINC}} \text{FINC}_i + \pi_{\text{ALTZ}} \text{ALTZ}_i \\
+ \pi_{\text{MGR}} \text{MGR}_i + \pi_{\text{CASH}} \text{CASH}_i + \pi_{\text{OPTI}} \text{OPTI}_i + \pi_{\text{HERF}} \text{HERF}_i + \epsilon_i
\]  

(21)

28 The adjusted R-squared from using the current ratio was slightly higher. The results remain virtually unchanged when using the current ratio instead.
$d_i, \tilde{\beta}_{MKT,i}$ and $OTHER_i$ have the same definitions as in Table III discussed earlier based on the firms’ stated method of computing its cost of capital. $IDIO_i$ is equal to the $(1 - R^2)$ value of the firm for all the firms in the sample. $R^2$ of the firm is calculated as the R-squared of the regression of the excess return of the survey firm on the value weighted returns of the market portfolio over the five year period ending 2003 (i.e. 1999-2003). $FINC_i$ is a measure of financial constraints constructed from the survey. It is an indicator variable that is one when firms responded to survey Question 20b (“There are some good projects we cannot take due to limited access to capital markets”) with “important” or “very important”. $ALTZ_i$ is an indicator variable which is one when the Altman Z-score of a firm is greater than 3 (referring to the least constrained firms). $MGRC_i$ is a measure of managerial constraints constructed from the survey. It is an indicator variable that takes the value of one when the response to survey Question 20c, “We cannot take all profitable projects due to limited resources in the form of limited qualified management and manpower”, is “important” or “very important”. $CASH_i$ is the ratio of the book value of cash to the market value of assets of the firm. $OPTI_i$ is a measure of optimism constructed from the survey. It is an indicator variable that takes the value of one when firms respond to Question 20a “We need a higher hurdle rate to account for optimism in cash flow forecasts” with “important” or “very important”. $HERF_i$ is a type of Herfindahl Index used as a measure of concentration of segments within a firm. It is calculated as the sum of squares of market shares of each segment of the firm (by net sales).

Table X reports the results for the full model. Column (1) shows the results when regressing the adjusted discount rate on the set of explanatory variables that were significant in our previous analysis. For the subset of firms that use WACC to assess their discount rates, we repeat the analysis in column (2) with the reported discount rates as the dependent variable. In this specification we include again the explanatory variable that captures the part of WACC which is related to cost of debt and the risk-free rate \[ \tilde{\omega}_i = \frac{D_i}{D_i + E_i} r_{D,i} (1 - \tau_i) + \frac{E_i}{D_i + E_i} r_{F,i}. \] We expect $\pi_{\tilde{\omega}}$ to be equal to one, if the model is correctly specified. Even though its value is still considerably smaller than one, $\pi_{\tilde{\omega}}$ increases substantially compared to Table IV and an $F$-test cannot reject the null hypothesis that it is one.
As we have shown before, it is important to model the non-linear dependence of the discount rate on the individual WACC components. Therefore, the adjusted R-squared of model (1) is more than twice the value of model (2), where we regress stated discount rates on the firms’ equity betas and a second term containing the remainder of WACC (its coefficient is denoted as $\pi_{W}$).

Once we combine idiosyncratic risk and cash as explanatory variables, the significance of idiosyncratic risk decreases is reduced to the 10% level. Adding idiosyncratic risk alone to the fundamental beta (scaled by the weight of equity in WACC), the coefficient was 0.0939 and significant at the 1% level. However, idiosyncratic risk still remains important for explaining the wedge between discount rates and cost of capital.

In both specifications financially constrained firms use lower discount rates. The survey question whether managers think that their firm is subject to financial constraints is negative and significant at the 1% level. High levels of Altman’s Z-score describe financially healthy firms. Its coefficient is positive in both specifications of the model, indicating that financially healthy firms use higher discount rates. Its significance fades in model (2). The coefficient on cash is positive and significant. Opler, Pinkowitz, Stulz, and Williamson (1999) document that firms holding high levels of cash subsequently engage in more acquisition activity. At the same time, firms with high levels of cash will most likely also be classified as financially unconstrained. Thus, it appears that firms seeking financial flexibility, i.e. firms that are unconstrained and hold large cash balances, use high discount rates. We therefore use the negative value of Altman’s conventional Z-score as a measure of financial constraints. Thus, while financial constraints would imply higher discount rates, the cash holdings are in line with firms having real options. At the same time high levels of cash coincide with financial flexibility and thus no financial constraints.

Correcting for optimistic cash flow estimates does not play an important role in determining the firm’s discount rate. The intercept is less than half in absolute value when compared to the model with only the cost of capital (column (3) in Table III) and is not different from zero after allowing for sampling errors – an indication that our model of discount rate is nearly unbiased. When regressing stated discount rates on the same set of variables in column (2), with the exception of Altman’s Z-score, all coefficients remain significant. The equity risk premium that we infer in
column (1) matches the survey findings documented by Graham and Harvey (2005) an also the standard error of the coefficient is relatively low.

VI. Conclusions

We find that most firms use discount rates that exceed their cost of capital by a wide margin. While on average, firms use discount rates that are about twice their cost of capital, there is substantial cross sectional variation among firms. Financial constraints have been historically invoked to be one of the primary driving factors of the large gap between cost of capital and discount rates. Because firms that are financially constrained, by definition, cannot take every positive NPV project available to them and will be rationing the available capital among projects, it is reasonable to expect that these firms would use higher discount rates. We use various proxies for financial constraints to measure how severely a firm is financially constraint.

The surprising finding is that firms that are more financially constrained tend to use lower discount rates which is consistent with the view that such firms are also short on interesting ideas. At the same time cash holding is positively related to discount rates. We interpret this as evidence suggesting that firms expecting valuable investment opportunities to arise in the future tend to hoard cash that gives them the financial flexibility to exploit those options in the best possible manner as and when they emerge.

Interestingly, our model implied equity risk premium match those of the CFO surveys of Graham and Harvey (2005). These results regarding the equity premium are robust to different specifications of the model, providing some cross validation of our model specification.

While the early capital budgeting literature focused on financial constraints and mutually exclusive projects to explain why some firms would forgo positive NPV projects, our findings suggest that we should shift our attention to organizational and managerial capacity constraints. Little attention has been paid to the real organizational constraints on firms. Our survey-based measure of managerial and organizational constraints is statistically significant, and is consistent with the view that firms that face tighter organizational and managerial capacity constraints will use discounts rates higher than cost of capital.
Appendix A: Debt Rates

In order to compute the debt rate of a survey firm, we first predict its credit rating from accounting data, and then use the predicted rating to impute the risk premium to be that of an average firm in 2003 with a similar credit rating. Finally, we use survey data on the average life of a typical project to determine the corresponding Treasury bond yield and add the risk premium to arrive at the cost of debt of the firm.

We use the following model of Jorion et al. (2009) to predict the firm’s credit rating:

\[
\text{Credit rating} = -1.42 + a \times \text{Interest coverage} + 1.801 \times \text{Operating margin} - 4.09 \\
\times \text{Long-term leverage} + 1.128 \times \text{Total leverage} + 0.405 \\
\times \text{Log market value} - 0.309 \times \text{Market model beta} - 1.165 \\
\times \text{Market model standard error}
\]

The coefficient \(a\) depends on the interest coverage variable as follows: -0.008 if interest coverage \(\geq 0.2\), 0.042 if \(0.1 \leq \text{interest coverage} < 0.2\), 0.02 if \(0.05 \leq \text{interest coverage} < 0.1\) and 0.311 if \(0 \leq \text{interest coverage} < 0.05\). The definitions of all accounting variables are consistent with Jorion et al. (2009). The equation generates a cutoff point that maps into a credit rating for each firm.

As a robustness check for the 41 firms in our sample for which we have both the actual S&P long-term domestic issuer rating and predicted ratings, Figure A.1 shows a scatter plot of the actual rating on the vertical axis and the predicted rating on the horizontal axis, where the numbers represent ratings in ascending order with AAA being 1 and CCC and below being 7. The Spearman rank order correlation for this data series is 0.995 indicating almost prefect prediction.

[Insert Figure A.1 here]

In order to compute the credit spread we use the average of the five- and ten-year spread as shown in the Table A.I. We take the average life of a typical project of each survey firm from the responses to Question 3 in the survey. The question reads: “What is the typical life of a project that your firm considers? ______ year(s)”. Using this data, we know the average life of a typical
project in the firm. The debt rates are now found using by adding the credit spread from Table A.I that matches the firms predicted credit rating and add it to the Treasury rate from Figure A.1 corresponding to the typical project life using linear interpolation.

[Insert Table A.I here]

**Appendix B: Alternative Beta Estimates and Estimates of Marginal Corporate Tax Rates**

In our main text, we use fundamental beta coefficients provided by Barra as our estimates for CAPM beta $\beta_{MKT,i}$. For the firm’s marginal tax rate $\tau_i$ we use the pre-financing marginal tax rate of Graham (1996a, 1996b). The following tables show the results of Table III using historical beta and Bloomberg’s shrinkage beta, a technique of adjusting betas that was proposed by Blume (1975), and three scenarios of simplified marginal tax rate calculations. In both tables we repeat in column (1) the results from Table III.

[Insert Table B.I here]

[Insert Table B.II here]

**Appendix C: Survey Results for Select Questions**

Table C.I shows the results of select questions on discount rates from our survey.

[Insert Table C.I here]
References


Malmendier, Ulrike, and Geoffrey Tate, 2005. CEO overconfidence and corporate investment, *Journal of Finance* 60(6), 2661-2700.


Figure 1: Discount Rates vs. Cost of Financial Capital

The scatter plot shows the self-reported discount rates from the survey against the cost of financial capital for the sample of 86 firms for which we can match with Compustat and fundamental Barra beta. Cost of financial capital corresponds to either WACC, levered cost of equity, or unlevered cost of equity, depending on what method the firm uses (Question 15). For firms that answered to use other methods, we compare the self-reported discount rate with the cost of levered equity. The equity premium corresponds to the 3.89% from our model in Section V. The maturity for the riskfree rate is matched to the typical life of a project (Question 3) and the debt rates are predicted using the model of Jorion, Shi, and Zhang (2009). The details are described in Appendix A.
Figure 2: Adoption of DCF Methods, WACC, CAPM, and Company-wide Discount Rates Over Time

The surveys on capital budgeting practices of U.S. firms are listed in chronological order below the horizontal time axis. The scatter plot summarizes their findings regarding the percentage of firms that: (i) Use discounted cash flow (DCF) methods, including net present value (NPV), adjusted present value (APV), internal rate of return (IRR), and the profitability index (PI); (ii) use the weighted average cost of capital (WACC) to discount cash flows; (iii) employ the Capital Asset Pricing Model (CAPM) to compute cost of equity; and (iv) use a company-wide discount rate.
Figure 3: Self-Reported and Predicted Discount Rates

The scatter plot shows the adjusted discount rates, $\tilde{d}_i$, plotted against the predicted discount rates from the full model described in Section V and Table X.
Table I: Sample Firm Characteristics

Mean and median firm characteristics are tabulated for the 86 survey respondents for which we can match data from Barra and Compustat, the subsample of 64 survey respondents that use WACC to assess their discount rate, and the non-responding firms from Compustat. The Compustat sample excludes the 86 survey firms and the firms we did not send a questionnaire to: Utilities, radio/TV broadcasting, cable, and other pay TV services (SIC codes 4840-4999), finance and insurance companies (6000-6499 and 6700-6799), and health, educational, and social services, and museums (7200+). Book value of assets is Compustat item at, market value of assets is calculated as at eq + csho × prcc_f, current ratio is current assets divided by current liabilities, act / lct, total debt is the sum of debt in current liabilities plus long-term debt, dlc + dltt, operating income is before depreciation, oibd, return on book equity is the ratio net income divided by book common equity, ni / ceq, and number of employees is Compustat item emp. All ratios are winsorized at 1% and 99%.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Compustat</th>
<th>Survey Firms (N=86)</th>
<th>WACC Firms (N=64)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>Book assets</td>
<td>5,256</td>
<td>2,789</td>
<td>151</td>
</tr>
<tr>
<td>Market assets</td>
<td>4,635</td>
<td>4,615</td>
<td>259</td>
</tr>
<tr>
<td>Sales</td>
<td>5,228</td>
<td>2,322</td>
<td>130</td>
</tr>
<tr>
<td>Market-to-book assets</td>
<td>4,622</td>
<td>4.98</td>
<td>1.65</td>
</tr>
<tr>
<td>Sales-to-book assets</td>
<td>5,213</td>
<td>1.05</td>
<td>0.84</td>
</tr>
<tr>
<td>Cash to-book assets</td>
<td>5,199</td>
<td>0.16</td>
<td>0.08</td>
</tr>
<tr>
<td>Current ratio</td>
<td>5,130</td>
<td>3.04</td>
<td>1.83</td>
</tr>
<tr>
<td>Total debt-to-book assets</td>
<td>5,230</td>
<td>0.39</td>
<td>0.21</td>
</tr>
<tr>
<td>Capital exp.-to-book assets</td>
<td>5,196</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Operating inc.-to-book asset</td>
<td>5,193</td>
<td>-0.23</td>
<td>0.08</td>
</tr>
<tr>
<td>Return on equity</td>
<td>5,209</td>
<td>0.00</td>
<td>0.06</td>
</tr>
<tr>
<td># employees-to-book assets</td>
<td>4,678</td>
<td>0.01</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Table II: Discount Rates and Cost of Financial Capital of Survey Firms

Panel A shows summary statistics on (self-reported) discount rates by what firms state it represents and Panel B by one-digit SIC industry. In Panel C we report the ratios when dividing the discount rates by the firms’ cost of capital, which either corresponds to WACC, cost of unlevered equity, or cost of levered equity using the Barra fundamental beta and the CAPM to compute the cost of equity capital. For firms using some other methods we divide their discount rate by the cost of levered equity. We report these ratios for two different equity premiums: 3.89% (inferred from our model which we discuss in Section V) and 7.5%.

Panel A: Discount Rates by Capital Budgeting Method

<table>
<thead>
<tr>
<th>Method</th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>25th Quantile</th>
<th>75th Quantile</th>
</tr>
</thead>
<tbody>
<tr>
<td>WACC</td>
<td>64</td>
<td>14.01</td>
<td>14.50</td>
<td>3.65</td>
<td>11.75</td>
<td>15.00</td>
</tr>
<tr>
<td>Cost of unlevered equity</td>
<td>6</td>
<td>17.42</td>
<td>15.50</td>
<td>6.12</td>
<td>12.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Cost of levered equity</td>
<td>3</td>
<td>16.67</td>
<td>15.00</td>
<td>2.89</td>
<td>15.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>18.92</td>
<td>15.00</td>
<td>6.23</td>
<td>15.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>15.08</td>
<td>15.00</td>
<td>4.62</td>
<td>12.00</td>
<td>16.50</td>
</tr>
</tbody>
</table>

Panel B: Discount Rates by Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>SIC</th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>25th Quantile</th>
<th>75th Quantile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining, construction</td>
<td>1</td>
<td>10</td>
<td>14.95</td>
<td>14.25</td>
<td>3.86</td>
<td>12.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>2, 3</td>
<td>55</td>
<td>15.77</td>
<td>15.00</td>
<td>5.24</td>
<td>12.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Transport, communication</td>
<td>4</td>
<td>10</td>
<td>12.30</td>
<td>12.00</td>
<td>2.10</td>
<td>11.50</td>
<td>15.00</td>
</tr>
<tr>
<td>Wholesale and retail</td>
<td>5</td>
<td>9</td>
<td>14.22</td>
<td>15.00</td>
<td>2.24</td>
<td>15.00</td>
<td>15.00</td>
</tr>
<tr>
<td>Hotels, motels, apartments</td>
<td>6, 7a</td>
<td>2</td>
<td>14.50</td>
<td>14.50</td>
<td>0.71</td>
<td>14.00</td>
<td>15.00</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>15.08</td>
<td>15.00</td>
<td>4.62</td>
<td>12.00</td>
<td>16.50</td>
<td></td>
</tr>
</tbody>
</table>

*a The 4-digit SIC codes are 6513 and 7011.
Panel C: Ratios Discount Rate Divided by Cost of Financial Capital

<table>
<thead>
<tr>
<th>Method</th>
<th>C.1: Equity premium 3.89%</th>
<th>C.2: Equity premium 7.50%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>WACC</td>
<td>64</td>
<td>2.00</td>
</tr>
<tr>
<td>Cost of unlevered equity</td>
<td>6</td>
<td>3.09</td>
</tr>
<tr>
<td>Cost of levered equity</td>
<td>3</td>
<td>2.27</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>3.43</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>2.30</td>
</tr>
</tbody>
</table>
Table III: Modeling Discount Rates Using the Cost of Capital

This table summarizes results from linear regressions that model firms’ discount rates as their cost of capital. All the regressions may be represented in the following manner:

\[ \tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{MKT,i} + \pi_{OTHER} OTHER_i + \epsilon_i. \]

The sample in column (1) includes the 64 firms that use WACC as their discount rate. For these 64 firms,

\[ \tilde{d}_i = d_i - \frac{D_i}{D_i + E_i} r_{D,i} (1 - \tau_i) - \frac{E_i}{D_i + E_i} r_{F,i}, \]

\[ \tilde{\beta}_{MKT,i} = \frac{E_i}{D_i + E_i} \beta_{MKT,i} \text{ and } OTHER_i = 0. \]

\( d_i \) is the discount rate of firm \( i \) from the survey, \( D_i \) is the book value of debt, \( E_i \) is the market value of equity, \( r_{D,i} \) is the firm’s debt rate imputed from its predicted debt rating (see Appendix A.1), \( \tau_i \) is the pre-financing marginal tax rate of Graham (2000), \( r_{F,i} \) is the Treasury rate matched to each firm’s average project life, and \( \beta_{MKT,i} \) is the firm’s fundamental Barra beta. \( \pi_0 \) is a constant, \( \pi_{EP} \) is the equity premium, and \( \epsilon_i \) is an idiosyncratic error.

In column (2), we add the 6 firms using unlevered cost of equity as their cost of capital. For these 6 firms,

\[ \tilde{d}_i = d_i - \frac{D_i}{D_i + E_i} r_{D,i} - \frac{E_i}{D_i + E_i} r_{F,i}, \]

\[ \tilde{\beta}_{MKT,i} = \frac{E_i}{D_i + E_i} \beta_{MKT,i} \text{ and } OTHER_i = 0. \]

Column (3) further adds 3 firms that indicate to use the cost of levered equity as their cost of capital. For these firms,

\[ \tilde{d}_i = d_i - r_{F,i}, \]

\[ \tilde{\beta}_{MKT,i} = \beta_{MKT,i} \text{ and } OTHER_i = 0. \]

In column (4), we add the 13 firms that use other methods to compute their cost of capital. For these firms,

\[ \tilde{d}_i = d_i, \]

\[ \tilde{\beta}_{MKT,i} = 0 \text{ and } OTHER_i = 1, \] indicating that the firm belongs to the “other” category.

Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level.
<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) WACC</th>
<th>(2) WACC + Unlevered</th>
<th>(3) WACC + Unlevered + Levered</th>
<th>(4) All Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_{MKT}$</td>
<td>0.0515*** (0.0133)</td>
<td>0.0572*** (0.0136)</td>
<td>0.0587*** (0.0128)</td>
<td>0.0587*** (0.0129)</td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
<td></td>
<td>0.1340*** (0.0199)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.0558*** (0.0113)</td>
<td>0.0556*** (0.0108)</td>
<td>0.0550*** (0.0105)</td>
<td>0.0550*** (0.0105)</td>
</tr>
<tr>
<td>Observations</td>
<td>64</td>
<td>70</td>
<td>73</td>
<td>86</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.211</td>
<td>0.219</td>
<td>0.239</td>
<td>0.424</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.199</td>
<td>0.208</td>
<td>0.228</td>
<td>0.411</td>
</tr>
</tbody>
</table>
Table IV: Relating Discount Rates to the Components of the Weighted Average Cost of Capital

This table summarizes results from linear regressions of the firms’ discount rate on the components of WACC. The dependent variable in all the regressions is the firms’ discount rate $h_i$ from the survey. The sample is restricted to the 64 firms that respond to use WACC to compute their cost of capital.

In column (1), the independent variable is the firms’ Barra beta $\beta_{MKT,i}$. In column (2), the independent variables are the various components of WACC which appear in the equations in Table III: $\beta_{MKT}$ is the fundamental beta provided by Barra, $D_i/(D_i + E_i)$ is the debt-to-total capital ratio where $D_i$ is the book value of debt and $E_i$ is the market value of equity, $r_{D,i}$ is the firm’s debt rate imputed from its predicted debt rating, $\tau_i$ is the pre-financing marginal tax rate of Graham (2000), the risk-free rate $r_{F,i}$ is the Treasury rate matched to each firm’s average project life indicated in the survey, and $\pi_0$ is a constant.

In column (3), the following regression is performed:

$$d_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{\omega}\tilde{w}_i + \epsilon_i,$$

$$\tilde{\beta}_{MKT,i} = \frac{E_i}{D_i + E_i} \beta_{MKT,i} \text{ and } \tilde{w}_i = \frac{D_i}{D_i + E_i} r_{D,i}(1 - \tau_i) + \frac{E_i}{D_i + E_i} r_{F,i}.$$

$\pi_0$ is a constant, $\pi_{EP}$ is the equity premium and $\pi_{\omega}$ is a coefficient which is expected to be one if the model is correctly specified. $D_i$ is the book value of debt, $E_i$ is the market value of equity, $r_{D,i}$ is the firm’s debt rate imputed from its predicted debt rating, $\tau_i$ is the pre-financing marginal tax rate of Graham (2000), $r_{F,i}$ is the Treasury rate matched to each firm’s average project life, and $\beta_{MKT,i}$ is the firm’s fundamental Barra beta. $\pi_0$ is a constant, $\pi_{EP}$ is the equity premium, and $\epsilon_i$ is an idiosyncratic error.

Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level.
<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) Beta</th>
<th>(2) WACC Components</th>
<th>(3) Cost of Debt and Cost of Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_{MKT}$</td>
<td>0.0133</td>
<td>0.0142</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0131)</td>
<td>(0.0128)</td>
<td></td>
</tr>
<tr>
<td>$D/(D + E)$</td>
<td>-0.0322</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0243)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r_D$</td>
<td>0.0564</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.1020)</td>
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<tr>
<td>$\tau$</td>
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<tr>
<td></td>
<td>(0.0350)</td>
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<td></td>
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<tr>
<td>$r_F$</td>
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<td></td>
<td>(0.5400)</td>
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<tr>
<td>$\bar{\beta}_{MKT}$</td>
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<td>0.0264*</td>
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</tr>
<tr>
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<td></td>
<td>(0.0143)</td>
<td></td>
</tr>
<tr>
<td>$\bar{\omega}$</td>
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<tr>
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<td>(0.2270)</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.1270***</td>
<td>0.1210***</td>
<td>0.1190***</td>
</tr>
<tr>
<td></td>
<td>(0.0128)</td>
<td>(0.0239)</td>
<td>(0.0186)</td>
</tr>
<tr>
<td>Observations</td>
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<tr>
<td>$R^2$</td>
<td>0.028</td>
<td>0.065</td>
<td>0.079</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.013</td>
<td>-0.015</td>
<td>0.048</td>
</tr>
</tbody>
</table>
Table V: Modeling Discount Rates Using Multifactor Models

This table summarizes the results of linear regressions that model the firms’ stated discount rates on different sets of systematic risk factors. The dependent variable in all regressions is the adjusted discount rate \( Y_t \) as defined in Table III based on the firms’ stated method of computing its cost of capital. Column (1) repeats the results of column (4) from Table III.

In column (2), we specify the cost of equity as a Fama-French 3-factor model:

\[
\tilde{d}_i = \pi_0 + \pi_{EP} \beta_{MKT,i} + \pi_{OTHER OTHER,i} + \pi_{SMB} \beta_{SMB,i} + \pi_{HML} \beta_{HML,i} + \epsilon_i,
\]

where \( \beta_{MKT,i} \) and \( OTHER_i \) have the same definitions as in Table III. \( \beta_{SMB,i} = \frac{E_i}{D_i + E_i} \beta_{SMB,i} \) and \( \beta_{HML,i} = \frac{E_i}{D_i + E_i} \beta_{HML,i} \) are defined analogous to \( \beta_{MKT,i} \), where Barra beta is replaced by the factor loadings \( \beta_{SMB} \) and \( \beta_{HML} \). We estimate the sets of systematic risk factors. The dependent variable in all regressions is the adjusted discount rate \( D_i + E_i \).

In column (2), we specify the cost of equity as a Fama-French 3-factor model:

\[
\tilde{d}_i = \pi_0 + \pi_{EP} \beta_{MKT,i} + \pi_{OTHER OTHER,i} + \pi_{INFL} \beta_{INFL,i} + \epsilon_i,
\]

where \( \beta_{INFL,i} = \frac{E_i}{D_i + E_i} \beta_{INFL,i} \) and the inflation beta is computed as follows: First, each month the product of the Barra beta and the market return, \( \beta_{MKT,i} \gamma_{M,L,i} \), is subtracted from its excess return, \( r_{LM,i}^* = r_{LM,i} - r_{F,t} \). Second, these excess returns \( r_{LM,i}^* \) are regressed against the monthly inflation rates, \( INF_L = \log CPIA_t - \log CPIA_{t-1} \), where \( CPIA_t \) is the seasonally adjusted Consumer Price Index (all urban consumers, U.S. city average, all items; CUSR000SA0 series) from the Bureau of Labor Statistics. The coefficient on the inflation return is the firm’s inflation beta \( \beta_{INFL,i} \).

In column (4), we have a 2-factor model with the equity beta and a currency.

\[
\tilde{d}_i = \pi_0 + \pi_{EP} \beta_{MKT,i} + \pi_{OTHER OTHER,i} + \pi_{FX} \beta_{FX,i} + \epsilon_i,
\]

where \( \beta_{FX,i} = \frac{E_i}{D_i + E_i} \beta_{FX,i} \) and the currency beta is computed in the same manner as the inflation beta, replacing the inflation index in the second step with the returns of the USD-Yen index. The coefficient on the USD-Yen return is the currency beta \( \beta_{FX,i} \).

Model (5) includes the macroeconomic factors from Chen, Roll, and Ross (1986).

\[
\tilde{d}_i = \pi_0 + \pi_{EP} \beta_{MKT,i} + \pi_{OTHER OTHER,i} + \pi_{MP} \beta_{MP,i} + \pi_{UI} \beta_{UI,i} + \pi_{DEI} \beta_{DEI,i} + \pi_{UTS} \beta_{UTS,i} + \pi_{UPR} \beta_{UPR,i} + \epsilon_i,
\]

where \( \beta_{MP,i} = \frac{E_i}{D_i + E_i} \beta_{MP,i} \), \( \beta_{UI,i} = \frac{E_i}{D_i + E_i} \beta_{UI,i} \), \( \beta_{DEI,i} = \frac{E_i}{D_i + E_i} \beta_{DEI,i} \), \( \beta_{UTS,i} = \frac{E_i}{D_i + E_i} \beta_{UTS,i} \), and \( \beta_{UPR,i} = \frac{E_i}{D_i + E_i} \beta_{UPR,i} \). Analogous to the inflation beta, \( \beta_{INFL,i} \), above, we regress the monthly excess return \( r_{LM,i}^* \) on \( MP_t, \)

\[
U_t, DEI_t, UTS_t, \text{ and } UPR_t,\] respectively, over the previous five years to get the estimates of \( \beta_{MP,i}, \beta_{UI,i}, \beta_{DEI,i}, \beta_{UTS,i}, \text{ and } \beta_{UPR,i} \). \( MP_t = \log IP_t - \log IP_{t-1} \) is the monthly growth rate in industrial production, where \( IP_t \) is the Industrial Production Index (INDPRO series) in month \( t \) from the FRED database at the Federal Reserve Bank of St. Louis, which measures real output of facilities located in the U.S. in manufacturing, mining, electric, and gas utilities. \( \begin{align*} U_t &= INF_L t - E[INF_L t - 1] \end{align*} \) is the unanticipated inflation, where \( INF_L t \) is the inflation rate based on the seasonally adjusted Consumer Price Index as above. \( E[INF_L t - 1] = r_{F,t} - E[RHO_t t - 1] \), where \( r_{F,t} \) is the one-month Treasury bill rate from CRSP (file crsp.mcti, variable t30ret) and \( RHO_t = r_{F,t} - l_t \). \( DEI_t = E[INF_L t + 1 t] - E[INF_L t + 1 t - 1] \) is the change in expected inflation. \( UTS \) is the unanticipated change in the term structure, defined as the difference between the 20-year (20-Year Treasury
Constant Maturity Rate; series GS20) minus the 1-year (1-Year Treasury Constant Maturity Rate; series DGS1) Treasury yield from the FRED database at the Federal Reserve Bank of St. Louis. UPR is the unanticipated change in the risk premium, defined as the Baa-Aaa yield spread (Moody’s Seasoned Baa Corporate Bond Yield minus Moody’s Seasoned Aaa Corporate Bond Yield) from the FRED database at the Federal Reserve Bank of St. Louis.

In column (6), we use the same specification as in column (1) and add a measure of idiosyncratic risk faced by the firm as an explanatory variable.

$$\tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{MKT,i} + \pi_{OTHER} OTHER_i + \pi_{IDIO} IDIO_i + \epsilon_i,$$

where $IDIO_i = (1 - R^2)$ and $R^2$ is calculated as the R-squared of the regression of the excess return of the survey firm on the value weighted returns of the market portfolio over the five year period 1999-2003.

Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level.
<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) CAPM</th>
<th>(2) Fama-French</th>
<th>(3) Inflation</th>
<th>(4) Currency</th>
<th>(5) Chen-Roll-Ross</th>
<th>(6) Idiosyncratic Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>Beta</td>
<td>Beta</td>
<td>Beta</td>
<td>Beta</td>
<td>Beta</td>
</tr>
<tr>
<td></td>
<td>MKT</td>
<td>SMB</td>
<td>HML</td>
<td>INF</td>
<td>FX</td>
<td>MP</td>
</tr>
<tr>
<td>β_MKT</td>
<td>0.0587*** (0.0129)</td>
<td>0.0525*** (0.0146)</td>
<td>0.0506*** (0.0138)</td>
<td>0.0572*** (0.0134)</td>
<td>0.0572*** (0.0133)</td>
<td>0.0602*** (0.0131)</td>
</tr>
<tr>
<td>β_SMB</td>
<td>0.0040 (0.0080)</td>
<td>-0.0060 (0.0077)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>β_HML</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>β_INF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>β_FX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.0081 (0.0184)</td>
</tr>
<tr>
<td>β_MP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.0028** (0.0012)</td>
</tr>
<tr>
<td>β_UI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.0002 (0.0007)</td>
</tr>
<tr>
<td>β_DEI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0000 (0.0003)</td>
</tr>
<tr>
<td>β_UTS</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0020 (0.0018)</td>
</tr>
<tr>
<td>β_UPR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.0007 (0.0006)</td>
</tr>
<tr>
<td>IDIO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td>0.1340*** (0.0199)</td>
<td>0.1290*** (0.0212)</td>
<td>0.1300*** (0.0202)</td>
<td>0.1330*** (0.0204)</td>
<td>0.1350*** (0.0207)</td>
<td>0.1320*** (0.0195)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0550*** (0.0105)</td>
<td>0.0604*** (0.0125)</td>
<td>0.0591*** (0.0110)</td>
<td>0.0565*** (0.0113)</td>
<td>0.0543*** (0.0112)</td>
<td>-0.0289 (0.0326)</td>
</tr>
<tr>
<td>Observations</td>
<td>86</td>
<td>86</td>
<td>86</td>
<td>86</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>R²</td>
<td>0.424</td>
<td>0.431</td>
<td>0.452</td>
<td>0.426</td>
<td>0.476</td>
<td>0.458</td>
</tr>
<tr>
<td>Adjusted R²</td>
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<td>0.402</td>
<td>0.431</td>
<td>0.405</td>
<td>0.429</td>
<td>0.438</td>
</tr>
</tbody>
</table>
**Table VI: Managerial Optimism**

This table summarizes the result of regressions of firms’ cost of capital on WACC and measures of optimism in cash flows.

In column (1), the following specification is used:

\[
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OTHER}\text{OTHER}_i + \pi_{OPTI}\text{OPTI}_i + \epsilon_i,
\]

where \(\tilde{d}_i\), \(\tilde{\beta}_{MKT,i}\) and \(\text{OTHER}_i\) have the same definitions as in Table III based on the firms’ stated method of computing its cost of capital. \(\text{OPTI}_i\) is an indicator variable which takes the value of one when firms respond to Question 20a “We need a higher hurdle rate to account for optimism in cash flow forecasts” with “agree” or “strongly agree”.

In column (2), we use the following specification:

\[
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OTHER}\text{OTHER}_i + \pi_{SEGM}\text{SEGM}_i + \epsilon_i,
\]

where \(\text{SEGM}_i\) is the total number of business segments in the firm.

Column (3) introduces two indicator variables instead to describe the number of business segments:

\[
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OTHER}\text{OTHER}_i + \pi_{SEG\,4-10}\text{SEG\,4-10}_i + \pi_{SEG\,>10}\text{SEG\,>10}_i + \epsilon_i,
\]

where \(\text{SEG\,4-10}_i\) is an indicator variable which takes the value of one if the number of business segments in the firm is between four and ten. \(\text{SEG\,>10}_i\) is an indicator variable which takes the value of one if the number of business segments in the firm is greater than ten.

In column (4), the following specification is used:

\[
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OTHER}\text{OTHER}_i + \pi_{HERF}\text{HERF}_i + \epsilon_i,
\]

where \(\text{HERF}_i\) is a type of Herfindahl Index used as a measure of concentration of segments within a firm. It is calculated as the sum of squares of market shares of each segment of the firm (by net sales).

In column (5), the following specification is used:

\[
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OTHER}\text{OTHER}_i + \pi_{SIZE}\text{SIZE}_i + \epsilon_i,
\]

where \(\text{SIZE}_i\) is the natural log of the market assets of the firm.

Robust standard errors are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level.
<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) Survey Answer</th>
<th>(2) # Business Segments</th>
<th>(3) Categorical Business Segments</th>
<th>(4) Concentration of Business Segments</th>
<th>(5) Firm Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_{EP}$</td>
<td>0.0567***</td>
<td>0.0585***</td>
<td>0.0588***</td>
<td>0.0589***</td>
<td>0.0573***</td>
</tr>
<tr>
<td></td>
<td>(0.0130)</td>
<td>(0.0128)</td>
<td>(0.0127)</td>
<td>(0.0130)</td>
<td>(0.0129)</td>
</tr>
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<td>OPTI</td>
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</tr>
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<td></td>
<td>(0.0096)</td>
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<td></td>
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</tr>
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<td></td>
</tr>
<tr>
<td></td>
<td>(0.0009)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>SEG4-10</td>
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<td>0.0027</td>
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<td>(0.0116)</td>
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<td>(0.0185)</td>
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<td></td>
</tr>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>(0.0026)</td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td>0.1331***</td>
<td>0.1320***</td>
<td>0.1340***</td>
<td>0.1340***</td>
<td>0.1330***</td>
</tr>
<tr>
<td></td>
<td>(0.0199)</td>
<td>(0.0205)</td>
<td>(0.0205)</td>
<td>(0.0201)</td>
<td>(0.0193)</td>
</tr>
<tr>
<td>Constant</td>
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<td>0.0606***</td>
<td>0.0554***</td>
<td>0.0536***</td>
<td>0.0745***</td>
</tr>
<tr>
<td></td>
<td>(0.0121)</td>
<td>(0.0122)</td>
<td>(0.0120)</td>
<td>(0.0127)</td>
<td>(0.0196)</td>
</tr>
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<td>84</td>
<td>86</td>
<td>86</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.425</td>
<td>0.428</td>
<td>0.426</td>
<td>0.425</td>
<td>0.435</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.403</td>
<td>0.407</td>
<td>0.398</td>
<td>0.404</td>
<td>0.414</td>
</tr>
</tbody>
</table>
Table VII: Short-Termism (Managerial Myopia)

This table summarizes the results of linear regressions that model the firms’ stated discount rates on different measures of short termism. The dependent variable in all regressions is the adjusted discount rate $\tilde{d}_i$.

In column (1), the following specification is used:

$$
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OTHER}\text{OTHER}_i + \pi_{MKTSHARE}\text{MKTSHARE}_i + \varepsilon_i,
$$

where $\tilde{d}_i$, $\tilde{\beta}_{MKT,i}$ and $\text{OTHER}_i$ have the same definitions as in Table III based on the firms’ stated method of computing its cost of capital. $\text{MKTSHARE}_i$ is the total sales of firm divided by the total sales in the firm’s two-digit industry.

In column (2), the following specification is used:

$$
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OTHER}\text{OTHER}_i + \pi_{INDHHI}\text{INDHHI}_i + \varepsilon_i,
$$

where $\text{INDHHI}_i$ is a type of Herfindahl Index used as a measure of concentration of firms in the industry. It is calculated as the sum of squares of market shares (measured by net sales) of each firm in the two-digit industry.

In column (3), the following specification is used:

$$
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OTHER}\text{OTHER}_i + \pi_{INDERC}\text{INDERC}_i + \varepsilon_i,
$$

where $\text{INDERC}_i$ is the industry earnings response coefficient in the firm’s Fama-French 30 industry classification (results are similar when using different windows to compute ERC or when using the Fama-French 48 industry classification). ERC measures the sensitivity of a firm’s stock price to earnings news and is calculated as in Asker, Farre-Mensa, Ljungqvist (2013).
<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) Market Share</th>
<th>(2) Industry Herfindahl Index</th>
<th>(3) Industry Earnings Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_{\text{MKT}}$</td>
<td>0.0598***</td>
<td>0.0559***</td>
<td>0.0578***</td>
</tr>
<tr>
<td></td>
<td>(0.0130)</td>
<td>(0.0135)</td>
<td>(0.0130)</td>
</tr>
<tr>
<td>MKTSHARE</td>
<td>-0.0111</td>
<td>-0.0683</td>
<td>-0.0322</td>
</tr>
<tr>
<td></td>
<td>(0.1110)</td>
<td>(0.0583)</td>
<td>(0.0355)</td>
</tr>
<tr>
<td>INDHHI</td>
<td></td>
<td>-0.0683</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0583)</td>
<td></td>
</tr>
<tr>
<td>INDERC</td>
<td></td>
<td></td>
<td>-0.0322</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.0355)</td>
</tr>
<tr>
<td>OTHER</td>
<td>0.1360***</td>
<td>0.1310***</td>
<td>0.1320***</td>
</tr>
<tr>
<td></td>
<td>(0.0202)</td>
<td>(0.0210)</td>
<td>(0.0206)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.535***</td>
<td>0.0615***</td>
<td>0.0625***</td>
</tr>
<tr>
<td></td>
<td>(0.0111)</td>
<td>(0.0130)</td>
<td>(0.0140)</td>
</tr>
<tr>
<td>Observations</td>
<td>86</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.431</td>
<td>0.429</td>
<td>0.427</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.410</td>
<td>0.408</td>
<td>0.407</td>
</tr>
</tbody>
</table>
Table VIII: Financial Constraints

This table summarizes the results of the regression of the firms’ stated discount rate on WACC and different measures of financial constraints.

In column (1), the following specification is used:

$$\tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{MKT,i} + \pi_{OTHER} OTHER_i + \pi_{FINC} FINC_i + \epsilon_i,$$

where $\tilde{d}_i$, $\tilde{\beta}_{MKT,i}$ and $OTHER_i$ have the same definitions as in Table III based on the firms’ stated method of computing its cost of capital. $FINC_i$ is a measure of financial constraints constructed from the survey. It is an indicator variable which is one when firms responded to survey Question 20b “There are some good projects we cannot take due to limited access to capital markets” with “agree” or “strongly agree”.

In column (2), the following specification is used:

$$\tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{MKT,i} + \pi_{OTHER} OTHER_i + \pi_{ALTZ} ALTZ_i + \epsilon_i,$$

where $ALTZ_i$ is an indicator variable which is one when the Altman Z-score of a firm is greater than 3 (referring to the least constrained firms).

In column (3), the following specification is used:

$$\tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{MKT,i} + \pi_{OTHER} OTHER_i + \pi_{CR} CR_i + \epsilon_i,$$

where $CR_i$ denotes the current ratio which is the ratio of current assets to current liabilities.

In column (4), the following specification is used:

$$\tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{MKT,i} + \pi_{OTHER} OTHER_i + \pi_{D/D+E} \frac{D_i}{D_i + E_i} + \epsilon_i.$$

In column (5), the following specification is used:

$$\tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{MKT,i} + \pi_{OTHER} OTHER_i + \pi_{KZ} KZ_i + \epsilon_i,$$

where $KZ_i$ is the Kaplan-Zingales index computed as in Lamont et al (2001).

Robust standard errors are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level.
<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) Survey Answer</th>
<th>(2) Altman’s Z-Score</th>
<th>(3) Current Ratio</th>
<th>(4) Debt-Equity Ratio</th>
<th>(5) Kaplan-Zingales Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \hat{\beta}_{\text{MKT}} )</td>
<td>0.0596***</td>
<td>0.0527***</td>
<td>0.0463***</td>
<td>0.0361**</td>
<td>0.0535***</td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{FINC}} )</td>
<td>-0.0129</td>
<td>(0.0108)</td>
<td>0.0284***</td>
<td>(0.0101)</td>
<td>0.00481***</td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{ALTZ}} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{CR}} )</td>
<td>0.00481***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{D/(D+E)}} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.0756***</td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{KF}} )</td>
<td>0.0114*</td>
<td>(0.00614)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{OTHER}} )</td>
<td>0.1359***</td>
<td>(0.0202)</td>
<td>0.135***</td>
<td>(0.0210)</td>
<td>0.132***</td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{CON}} )</td>
<td>0.0593***</td>
<td>(0.0107)</td>
<td>0.0456***</td>
<td>(0.0108)</td>
<td>0.0506***</td>
</tr>
<tr>
<td>Observations</td>
<td>85</td>
<td>84</td>
<td>85</td>
<td>86</td>
<td>85</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.432</td>
<td>0.479</td>
<td>0.498</td>
<td>0.483</td>
<td>0.432</td>
</tr>
<tr>
<td>Adjusted ( R^2 )</td>
<td>0.411</td>
<td>0.459</td>
<td>0.480</td>
<td>0.464</td>
<td>0.411</td>
</tr>
</tbody>
</table>
Table IX: Managerial Constraints

In column (1), the following specification is used:

\[ \tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{\text{MKT},i} + \pi_{OTHER} OTHER_i + \pi_{MGRC} MGRC_i + \varepsilon_i, \]

where \( \tilde{d}_i, \tilde{\beta}_{\text{MKT},i} \) and \( OTHER_i \) have the same definitions as in Table III based on the firms’ stated method of computing its cost of capital. \( MGRC_i \) is a measure of financial constraints constructed from the survey. It is an indicator variable which is one when firms responded to survey Question 20c (“We cannot take all profitable projects due to limited resources in the form of limited qualified management and manpower”) with “agree” or “strongly agree”.

In column (2), we add financial flexibility to the model instead:

\[ \tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{\text{MKT},i} + \pi_{OTHER} OTHER_i + \pi_{CASH} CASH_i + \varepsilon_i. \]

Where \( CASH_i \) is the ratio of the book value of cash to total capital.

Column (3) shows the results for the following regression:

\[ \tilde{d}_i = \pi_0 + \pi_{EP} \tilde{\beta}_{\text{MKT},i} + \pi_{OTHER} OTHER_i + \pi_{MGRC} MGRC_i + \pi_{CASH} CASH_i + \pi_{FINC} FINC_i + \varepsilon_i, \]

\( FINC_i \) is the measure of financial constraints constructed from the survey as defined in Table VII.

Robust standard errors are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level.
<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) Survey Answer</th>
<th>(2) Financial Flexibility</th>
<th>(3) Financial vs. Managerial</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \hat{\beta}_{\text{MKT}} )</td>
<td>0.0575***</td>
<td>0.0421***</td>
<td>0.0384***</td>
</tr>
<tr>
<td></td>
<td>(0.0127)</td>
<td>(0.0135)</td>
<td>(0.0121)</td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{MGRC}} )</td>
<td>0.0127</td>
<td></td>
<td>0.0227***</td>
</tr>
<tr>
<td></td>
<td>(0.0100)</td>
<td></td>
<td>(0.0084)</td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{CASH}} )</td>
<td>0.1653***</td>
<td></td>
<td>0.2130***</td>
</tr>
<tr>
<td></td>
<td>(0.0453)</td>
<td></td>
<td>(0.0593)</td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{FINC}} )</td>
<td>-0.0348***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.0092)</td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{OTHER}} )</td>
<td>0.1322***</td>
<td>0.1243***</td>
<td>0.1231***</td>
</tr>
<tr>
<td></td>
<td>(0.0207)</td>
<td>(0.0185)</td>
<td>(0.0182)</td>
</tr>
<tr>
<td>( \hat{\beta}_{\text{Constant}} )</td>
<td>0.0492***</td>
<td>0.0516***</td>
<td>0.0514***</td>
</tr>
<tr>
<td></td>
<td>(0.0114)</td>
<td>(0.0113)</td>
<td>(0.0107)</td>
</tr>
<tr>
<td>Observations</td>
<td>85</td>
<td>86</td>
<td>85</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.432</td>
<td>0.512</td>
<td>0.583</td>
</tr>
<tr>
<td>Adjusted ( R^2 )</td>
<td>0.411</td>
<td>0.494</td>
<td>0.557</td>
</tr>
</tbody>
</table>
Table X: Full Model

This table contains the results of the regression of firms’ cost of capital on WACC, idiosyncratic risk, financial constraints, managerial constraints and measures of optimism in cash flows.

In column (1), the following specification is used:

\[
\tilde{d}_i = \pi_0 + \pi_{EP}\tilde{\beta}_{MKT,i} + \pi_{OTHER}\beta_{OTHER,i} + \pi_{IDIO}\beta_{IDIO,i} + \pi_{FINC}\beta_{FINC,i} + \pi_{ALTZ}\beta_{ALTZ,i} + \pi_{MGRC}\beta_{MGRC,i} + \pi_{CASH}\beta_{CASH,i} + \pi_{OPTI}\beta_{OPTI,i} + \pi_{HERF}\beta_{HERF,i} + \epsilon_i,
\]

where \( \tilde{d}_i \), \( \tilde{\beta}_{MKT,i} \) and \( \beta_{OTHER,i} \) have the same definitions as in Table III based on the firms’ stated method of computing its cost of capital. \( IDIO_i \) is equal to the \( (1 - R^2) \) value of the firm for all the firms in the sample. \( R^2 \) of the firm is calculated as the R-squared of the regression of the excess return of the survey firm on the value weighted returns of the market portfolio over the five year period ending 2003 (i.e. 1999-2003). \( FINC_i \) is a measure of financial constraints constructed from the survey. It is an indicator variable which is one when firms responded to survey Question 20b (“There are some good projects we cannot take due to limited access to capital markets”) with “important” or “very important”. \( ALTZ_i \) is an indicator variable which is one when the Altman Z-score of a firm is greater than 3 (referring to the least constrained firms). \( MGRC_i \) is a measure of managerial constraints constructed from the survey. It is an indicator variable which takes the value of one when the response to survey Question 20c, “We cannot take all profitable projects due to limited resources in the form of limited qualified management and manpower”, is “important” or “very important”. \( CASH_i \) is the ratio of the book value of cash to the market value of assets of the firm. \( OPTI_i \) is a measure of optimism constructed from the survey. It is an indicator variable which takes the value of one when firms respond to Question 20a “We need a higher hurdle rate to account for optimism in cash flow forecasts” with “important” or “very important”. \( HERF_i \) is a type of Herfindahl Index used as a measure of concentration of segments within a firm. It is calculated as the sum of squares of market shares of each segment of the firm (by net sales).

In column (2) we use the same specification as in (1) for firms using WACC only.

In column (3), the following specification is used:

\[
d_i = \pi_0 + \pi_{EP}\beta_{MKT,i} + \pi_{OTHER}\beta_{OTHER,i} + \pi_{IDIO}\beta_{IDIO,i} + \pi_{FINC}\beta_{FINC,i} + \pi_{ALTZ}\beta_{ALTZ,i} + \pi_{MGRC}\beta_{MGRC,i} + \pi_{CASH}\beta_{CASH,i} + \pi_{OPTI}\beta_{OPTI,i} + \pi_{HERF}\beta_{HERF,i} + \pi_{\tilde{w}}\beta_i + \epsilon_i.
\]

The sample is restricted to the 64 firms that use WACC as their stated method of computing cost of capital. \( d_i \) is the firm’s stated cost of capital. \( \beta_{MKT,i} \) has the same definition as in Table III based on the firms’ stated method of computing its cost of capital. \( OTHER_i \) is set to zero, since the sample is restricted to the 64 firms that use WACC as their cost of capital. \( IDIO_i \), \( FINC_i \), \( ALTZ_i \), \( MGRC_i \), \( CASH_i \), \( OPTI_i \), and \( HERF_i \) have the same definitions as in column (1) of this table. \( \tilde{w}_i \) is defined below:

\[
\tilde{w}_i = \frac{D_i}{D_i + E_i}r_{D,i}(1 - \tau_i) + \frac{E_i}{D_i + E_i}r_{F,i},
\]

\( D_i \) is the book value of debt, \( E_i \) is the market value of equity, \( r_{D,i} \) is the firm’s debt rate imputed from its predicted debt rating, \( \tau_i \) is the pre-financing marginal tax rate of Graham (2000), and \( r_{F,i} \) is the Treasury rate matched to each firm’s average project life. We expect \( \pi_{\tilde{w}} \) to be equal to one, if the model is correctly specified. An F-test cannot reject the null hypothesis that \( \pi_{\tilde{w}} = 1 \).

Robust standard errors are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level.
<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) Full Sample</th>
<th>(2) Firms Using WACC Only</th>
<th>(3) Firms Using WACC Only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \hat{d} )</td>
<td>( \hat{d} )</td>
<td>( \hat{d} )</td>
</tr>
<tr>
<td>( \tilde{\beta}_{MKT} )</td>
<td>0.0389***</td>
<td>0.0412***</td>
<td>0.0310**</td>
</tr>
<tr>
<td></td>
<td>(0.0128)</td>
<td>(0.0129)</td>
<td>(0.0144)</td>
</tr>
<tr>
<td>( IDIO )</td>
<td>0.0760*</td>
<td>0.0705*</td>
<td>0.0604*</td>
</tr>
<tr>
<td></td>
<td>(0.0451)</td>
<td>(0.0401)</td>
<td>(0.0345)</td>
</tr>
<tr>
<td>( FINC )</td>
<td>-0.0302***</td>
<td>-0.0376***</td>
<td>-0.0335***</td>
</tr>
<tr>
<td></td>
<td>(0.0096)</td>
<td>0.0107</td>
<td>(0.0102)</td>
</tr>
<tr>
<td>( ALTZ )</td>
<td>0.0180**</td>
<td>0.0259***</td>
<td>0.0161</td>
</tr>
<tr>
<td></td>
<td>(0.0088)</td>
<td>0.0090</td>
<td>(0.0115)</td>
</tr>
<tr>
<td>( MGRC )</td>
<td>0.0238***</td>
<td>0.0231***</td>
<td>0.0202**</td>
</tr>
<tr>
<td></td>
<td>(0.0087)</td>
<td>(0.0085)</td>
<td>(0.0090)</td>
</tr>
<tr>
<td>( CASH )</td>
<td>0.1820***</td>
<td>0.1264**</td>
<td>0.1360***</td>
</tr>
<tr>
<td></td>
<td>(0.0487)</td>
<td>(0.0523)</td>
<td>(0.0504)</td>
</tr>
<tr>
<td>( OPTI )</td>
<td>-0.0109</td>
<td>-0.0073</td>
<td>-0.0059</td>
</tr>
<tr>
<td></td>
<td>(0.0084)</td>
<td>(0.0081)</td>
<td>(0.0084)</td>
</tr>
<tr>
<td>( HERF )</td>
<td>0.0009</td>
<td>0.0162</td>
<td>0.0225</td>
</tr>
<tr>
<td></td>
<td>(0.0215)</td>
<td>(0.0233)</td>
<td>(0.0243)</td>
</tr>
<tr>
<td>( \bar{w} )</td>
<td></td>
<td></td>
<td>0.5520*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.3070)</td>
</tr>
<tr>
<td>( OTHER )</td>
<td>0.1240***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0193)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.0206</td>
<td>-0.0215</td>
<td>0.0167</td>
</tr>
<tr>
<td></td>
<td>(0.0438)</td>
<td>(0.0395)</td>
<td>(0.0402)</td>
</tr>
<tr>
<td>Observations</td>
<td>82</td>
<td>62</td>
<td>62</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.628</td>
<td>0.536</td>
<td>0.354</td>
</tr>
<tr>
<td>Adjusted ( R^2 )</td>
<td>0.582</td>
<td>0.466</td>
<td>0.243</td>
</tr>
</tbody>
</table>
Table A.1: Credit Spreads

This table summarizes the spreads over Treasury rates by rating category. For the rating categories AAA through BB, we report the average of the 5-year and 10-year spreads of corporate bonds collected. The individual bond indices of different rating categories are from Bloomberg and include liquid traded bonds with weekly data starting 02/13/1996 and only bonds which have a minimum outstanding of USD 100 million.

For the rating category B, since the S&P data ends in 2002, the spread between AAA and B in 2002 is calculated. Using the 2003 yield of AAA rated bonds and the 2002 spread for B bonds over AAA bonds, the yields of B rated bonds are calculated to be 6.09%. For bond ratings which are CCC and below, the Bank of America Merrill Lynch US High Yield CCC or Below Option-Adjusted Spread (obtained from the Global Financial Database) is used to compute the average spread of 12.96% for these bonds in 2003.

<table>
<thead>
<tr>
<th>Credit Rating</th>
<th>Bloomberg Ticker 5-year Spread</th>
<th>10-year Spread</th>
<th>Average Credit Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>SPWC3A5</td>
<td>SPWC3A10</td>
<td>0.75%</td>
</tr>
<tr>
<td>AA</td>
<td>SPWC2A5</td>
<td>SPWC2A10</td>
<td>0.87%</td>
</tr>
<tr>
<td>A</td>
<td>SPWCA5</td>
<td>SPWCA10</td>
<td>1.13%</td>
</tr>
<tr>
<td>BBB</td>
<td>SPWC3B5</td>
<td>SPWC3B10</td>
<td>2.43%</td>
</tr>
<tr>
<td>BB</td>
<td>SPWC2B5</td>
<td>SPWC2B10</td>
<td>4.36%</td>
</tr>
<tr>
<td>B</td>
<td>SPWCB5</td>
<td>SPWCB10</td>
<td>6.09%</td>
</tr>
<tr>
<td>CCC and below</td>
<td></td>
<td></td>
<td>12.96%</td>
</tr>
</tbody>
</table>
Table B.I: Using Alternative Beta Estimates

We repeat the regression in column (4) of Table III using different definitions of the CAPM beta $\beta_{MKT}$. The dependent variable in all specifications is the transformed discount rate $\tilde{d}_i$. Column (1) is added for comparisons and repeats the results from Table III using the fundamental beta from Barra. In column (2) we use monthly data to estimate beta from a regression a firm’s returns on the returns of the S&P 500 over the past five years. Column (3) reports the firm’s Bloomberg shrinkage beta that puts a weight of 0.667 on the historical beta and 0.333 on one.

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) Barra Beta</th>
<th>(2) Historical Beta</th>
<th>(3) Shrinkage Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_{MKT}$</td>
<td>0.0587***</td>
<td>0.0305***</td>
<td>0.0522***</td>
</tr>
<tr>
<td></td>
<td>(0.0129)</td>
<td>(0.0106)</td>
<td>(0.0151)</td>
</tr>
<tr>
<td>OTHER</td>
<td>0.134***</td>
<td>0.112***</td>
<td>0.129***</td>
</tr>
<tr>
<td></td>
<td>(0.0199)</td>
<td>(0.0192)</td>
<td>(0.0208)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0550***</td>
<td>0.0771***</td>
<td>0.0599***</td>
</tr>
<tr>
<td></td>
<td>(0.0105)</td>
<td>(0.0092)</td>
<td>(0.0121)</td>
</tr>
<tr>
<td>Observations</td>
<td>86</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.424</td>
<td>0.361</td>
<td>0.395</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.411</td>
<td>0.346</td>
<td>0.381</td>
</tr>
</tbody>
</table>

Table B.II: Using Alternative Estimates of Marginal Corporate Tax Rates

We repeat the regression in column (4) of Table III using different specifications of the tax rate $\tau_i$. The dependent variable in all specifications is the transformed discount rate $\tilde{d}_i$. Column (1) is added for comparisons and repeats the results from Table III using the before-debt tax rate of Graham (2000). In column (2) we set tax rates to 0% for all firms, in (3) we use 34%, and in (4) the average tax rate of the firm (total tax paid divided by pre-tax income).

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) Graham</th>
<th>(2) 0% Rate</th>
<th>(3) 34% Rate</th>
<th>(4) Average Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_{MKT}$</td>
<td>0.0587***</td>
<td>0.0702***</td>
<td>0.0563***</td>
<td>0.0650***</td>
</tr>
<tr>
<td></td>
<td>(0.0129)</td>
<td>(0.0149)</td>
<td>(0.0129)</td>
<td>(0.0146)</td>
</tr>
<tr>
<td>OTHER</td>
<td>0.134***</td>
<td>0.149***</td>
<td>0.130***</td>
<td>0.142***</td>
</tr>
<tr>
<td></td>
<td>(0.0199)</td>
<td>(0.0211)</td>
<td>(0.0198)</td>
<td>(0.0208)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0550***</td>
<td>0.0398***</td>
<td>0.0589***</td>
<td>0.0475***</td>
</tr>
<tr>
<td></td>
<td>(0.0105)</td>
<td>(0.0127)</td>
<td>(0.0103)</td>
<td>(0.0121)</td>
</tr>
<tr>
<td>Observations</td>
<td>86</td>
<td>86</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.424</td>
<td>0.439</td>
<td>0.419</td>
<td>0.428</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.411</td>
<td>0.426</td>
<td>0.405</td>
<td>0.414</td>
</tr>
</tbody>
</table>
Table C.I: Survey Answers on Determinants of Discount Rates

The Table summarizes the results for three survey questions on the determinants of discount rates. For each question respondents answer on a scale from -2 (not important) to 2 (very important) and we show the frequency distributions of their answers.

Question 14: “How important are the following risk factors in determining the hurdle rate? a) Market risk of a project, defined as the sensitivity of the project returns to economic conditions b) Project risk that is unique to the firm and unrelated to the state of the economy.”

Question 13: “How important are the following factors in determining the hurdle rate you use? a) Whether it is a short-lived or long-lived project? b) Whether it is a strategic or non-strategic investment? c) Whether it is a replacement project or a new investment? d) Whether it is a revenue expansion or a cost reduction project? e) Whether it is a domestic project or a foreign project? f) Whether the project in question requires significantly more funds than the typical project your firm takes?”
Question 12: “If you were to change your hurdle rate(s), how important would the following factors be? a) Interest rate changes b) Cyclical changes in the economy c) Cyclical changes in the industry(ies) you operate in d) Changes in political uncertainty e) Changes in the expected risk premium f) Changes in the corporate tax rates.

- Tax rates
- Risk premium
- Political uncertainty
- Cyclical-industry
- Cyclical - economy
- Interest rate

Legend:
- Very important
- Important
- Neutral
- Not important
- Not at all important
This survey, sponsored by the Zell Center for Risk Research of Northwestern University's Kellogg School of Management, investigates how firms make investment decisions. While there have been numerous surveys on capital budgeting methods, cost of capital, etc., this is the first survey that examines all the components of the investment decision jointly. An article based on this survey will appear in the working paper series of the Kellogg School of Management and will also be submitted to an academic journal.

If you are not involved in the project evaluation related decisions we request that you pass this survey on to the manager(s) responsible for project acceptance/rejection decisions. Responses will be used in aggregate only. Thus, no company will be identified, discussed, or analyzed individually. We estimate that this survey will take 20 minutes. Please return the completed survey in the enclosed postage-paid envelope to the Finance Department (Iwan Meier), Kellogg School of Management, 2001 Sheridan Road, Evanston IL 60208 by September 23.

If you would like an advance copy of the results, please e-mail Iwan Meier (i-meier@kellogg.northwestern.edu) or Vefa Tarhan (v-tarhan@kellogg.northwestern.edu).

Thank you for taking the time to complete the survey.

I. Capital Budgeting

1. What capital budgeting method does your firm use? If you use multiple methods, please rank the two most important ones you rely on. (1 for first choice, 2 for second choice)

<table>
<thead>
<tr>
<th>Net Present Value (NPV)</th>
<th>Return on invested capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted Present Value (APV)</td>
<td>Discounted payback period</td>
</tr>
<tr>
<td>Internal Rate of Return (IRR)</td>
<td>Payback period</td>
</tr>
<tr>
<td>Average rate of return</td>
<td>Other (please specify)</td>
</tr>
<tr>
<td>Profitability index</td>
<td></td>
</tr>
</tbody>
</table>

For questions #2-4 please exclude acquisitions.

2. At what stage of a specific project’s life do you typically evaluate it? Please indicate with a cross on the time line below.

R&D | Product design | Test marketing | Initial investment in fixed and current assets | Sales

[Cross marks indicating time periods]

If you have any comments about this time line, please specify.

3. What is the typical life of a project that your firm considers? _______ year(s)

4. If your company evaluates some projects using payback or discounted payback, what is the range of the required payback period you use?

From _______ years to _______ years

☐ We do not use the (discounted) payback method.
II. Hurdle Rates/Risk

5. In evaluating projects, does your company use

☐ hurdle rates/target rates/discount rates that incorporate the expected future inflation (i.e. nominal hurdle rates)
☐ hurdle rates/target rates/discount rates that do not include inflation expectations (i.e. real hurdle rates)

6. In nominal terms (i.e. incorporating the expected future inflation), what is the hurdle your company has used for a typical project during the last two years?

______ %

7. Does your hurdle rate depend on the expected life of a project?

☐ Yes ☐ No
   If your answer is "Yes", do you use a higher rate for:
   ☐ longer life projects or
   ☐ shorter life projects

8. If you use multiple hurdle rates, what is the lowest and highest hurdle rate you use?

   Lowest hurdle rate _______ %
   Highest hurdle rate _______ %

9. In evaluating strategic projects (where accepting a given project today may enable the firm to make additional future investments), do you

☐ use a lower hurdle rate than you would for a similar non-strategic project
☐ value the potential projects in the future separately and add their value to the strategic project
☐ evaluate strategic projects in the same manner as non-strategic projects

If your company has multiple divisions/business segments please answer #10, otherwise skip to #11

10. If you calculate the hurdle rate for a division/business segment, do you

Never 2 1 0 1 2

☐ ☐ ☐ ☐ use the company-wide hurdle rate
☐ ☐ ☐ ☐ use the hurdle rate of firms that are in the same industry as the division in question (proxy firms)
☐ ☐ ☐ ☐ adjust the industry hurdle rate of proxy firms for tax rate, cost of debt, capital structure, etc., differences between your firm and proxy firms

11. How often did you change the hurdle rate(s) in the past three years?
☐ We have not changed the hurdle rate(s) during the past three years
☐ Once
☐ More than once

12. If you were to change your hurdle rate(s), how important would the following factors be?

Not important very important

☐ ☐ ☐ ☐ Interest rate changes
☐ ☐ ☐ ☐ Cyclical changes in the economy
☐ ☐ ☐ ☐ Cyclical changes in the industry(ies) you operate in
☐ ☐ ☐ ☐ Changes in political uncertainty
☐ ☐ ☐ ☐ Changes in the expected risk premium
☐ ☐ ☐ ☐ Changes in the corporate tax rates

13. How important are the following factors in determining the hurdle rate you use?

Not important very important

☐ ☐ ☐ ☐ Whether it is a short-lived or long-lived project
☐ ☐ ☐ ☐ Whether it is a strategic or non-strategic investment
☐ ☐ ☐ ☐ Whether it is a replacement project or a new investment
☐ ☐ ☐ ☐ Whether it is a revenue expansion or a cost reduction project
☐ ☐ ☐ ☐ Whether it is a domestic project or a foreign project
☐ ☐ ☐ ☐ Whether the project in question requires significantly more funds than the typical project your firm takes

14. How important are the following risk factors in determining the hurdle rate?

Not important very important

☐ ☐ ☐ ☐ Market risk of a project, defined as the sensitivity of the project returns to economic conditions
☐ ☐ ☐ ☐ Project risk that is unique to the firm and unrelated to the state of the economy

15. The hurdle rate you use represents the firm's

☐ weighted average cost of capital
☐ cost of levered equity capital
☐ cost of unlevered equity
☐ Other (please specify)
III. Cash Flows

16. In evaluating projects, the cash flows you use are calculated as:
- [ ] earnings before interest and after taxes (EBIT) + depreciation
- [ ] earnings before interest and after taxes (EBIT) + depreciation – capital expenditures – net change in working capital
- [ ] earnings
- [ ] earnings + depreciation
- [ ] earnings + depreciation – capital expenditures – net change in working capital
- [ ] Other (please specify)

17. In estimating future sales, cost of goods sold, etc., do you include the expected inflation rate in your cash flow projections?
- [ ] Yes
- [ ] No

18. In valuing projects, do you incorporate into the cash flows the money you spent before the period when you make the accept/reject decision?
- [ ] Yes
- [ ] No

19. If a new product will cause a decline in the sales of an existing product (erosion, cannibalization), do you subtract the erosion from the estimated sales figures of the new project?
- [ ] Yes
- [ ] Yes, but only if competitors are likely to introduce a product similar to the new product
- [ ] Yes, but only if the competitors are unlikely to introduce a similar product
- [ ] No

20. To what extent do these statements agree with your company's views?

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1 0 1 2</td>
<td></td>
</tr>
</tbody>
</table>

- [ ] We need a higher hurdle rate to account for optimism in cash flow forecasts
- [ ] There are some good projects we cannot take due to limited access to capital markets
- [ ] We cannot take all profitable projects due to limited qualified management and manpower
- [ ] We invest more in projects in years when the firm has more operating cash flows

21. How do you incorporate risk into project evaluation?

<table>
<thead>
<tr>
<th>Not important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1 0 1 2</td>
<td></td>
</tr>
</tbody>
</table>
- [ ] Increase the hurdle rate
- [ ] Decrease the estimated cash flows

If your firm does not have foreign investments, please skip questions #22 and #23.

22. For foreign investments do you
- [ ] use higher hurdle rates than for similar domestic projects
- [ ] use more conservative cash flow estimates than for similar domestic projects
- [ ] Both
- [ ] Neither
- [ ] Other

23. For foreign investments do you
- [ ] translate the foreign currency cash flows of the project into dollars by using forward rates and use the domestic (dollar based) hurdle rate
- [ ] discount foreign currency cash flows using the hurdle rate calculated from data of the foreign country in question
- [ ] Other

IV. Capital Structure

24. In deciding how to finance projects in your firm, in what order would you use the following sources of capital to fund profitable projects? (1 for first choice, 2 if the first choice does not raise sufficient amount of capital, 3 if the first two choices do not meet the project's total financing needs, 4, 5, etc.)

- Internally available excess cash balances
- Short term debt
- Long term debt
- Operating profits
- Equity issues
- Other (please specify)

25. The advantage of debt for your firm is that

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
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<td>2 1 0 1 2</td>
<td></td>
</tr>
</tbody>
</table>
- [ ] interest payments are tax-deductible
- [ ] it forces the firm to be more efficient
debt is a cheaper source of funds even
- [ ] if the interest payments were not tax-
deductible
- [ ] it provides substantial financial flexibility
26. The advantage of equity is that
- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly agree
- It increases the firm's flexibility
- It reduces costs of financial distress
- It does not obligate the firm to make payments to shareholders

27. What factors determine the optimal debt/equity mix of your firm?
- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly agree
- We borrow to the extent that the marginal interest tax shield becomes zero
- We do not borrow at all so the firm will not operate in financially distressed situations
- We borrow until the tax advantage becomes equal to the financial distress disadvantages of debt
- We borrow below our debt capacity so that if we run into very valuable projects in the future we can tap into the unused debt capacity

28. We would borrow more if
- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly agree
- We had more taxable income
- We had more tangible assets
- We were in a higher tax rate

V. Other

29. Compared with the current capital structure your company's intention for the next three years is to
- [ ] Keep your debt/equity ratio the same
- [ ] Increase your debt/equity ratio, i.e. move towards more debt than now
- [ ] Decrease your debt/equity ratio, i.e. move towards more equity than now

30. Company characteristics
- Industry
  - Retail and Wholesale
  - Mining, Construction
  - Manufacturing
  - Communication/Media
  - Technology (Software, Biotech, etc.)
  - Services
  - Utility
  - Other (please specify)
- Company characteristics (continued)
- Sales
  - [ ] < $100 million
  - [ ] $100,000 - $499 million
  - [ ] $500,000 - $999 million
  - [ ] $1 - $5 billion
  - [ ] > $5 billion

31. Does your firm have multiple product lines?
- [ ] Yes
- [ ] No

32. Company ownership
- [ ] Public
- [ ] Private
- If your answer is "Public," what is the firm's current price-to-earnings ratio? ______

33. What is the interest rate on senior long-term debt? ______

34. What is the approximate equity stake of senior management in the firm?
- [ ] _____ %
- [ ] Don't know

Our last two questions are about you and the ticker/name of your company. The ticker symbol will only be used to gather additional, publicly available data from databases such as Compustat. All responses will be used in aggregate only. No company will be identified, discussed or analyzed individually.

35. Information about the person completing the form
- Age
  - [ ] < 39
  - [ ] 39 - 49
  - [ ] 50 - 59
  - [ ] 60 - 69
  - [ ] > 69
- Time in job
  - [ ] < 4 years
  - [ ] 4 - 9 years
  - [ ] 10 - 14 years
  - [ ] 15 - 19 years
  - [ ] 20 - 24 years
  - [ ] 25 - 29 years
  - [ ] 30 - 34 years
  - [ ] 35 - 39 years
  - [ ] 40 - 44 years
  - [ ] 45 - 49 years
  - [ ] 50 - 54 years
  - [ ] 55 - 59 years
  - [ ] 60 - 64 years
  - [ ] 65 - 69 years
  - [ ] > 70 years
- Education
  - [ ] Undergraduate
  - [ ] MBA
  - [ ] Non MBA masters
  - [ ] Masters degree

What year did you graduate from your last school? ______

36. Ticker symbol or company name

Thank you for completing the survey!

Please return the completed survey in the enclosed postage-paid envelope to the
Finance Department (Iwan Meier), Kellogg School of Management, 2001 Sheridan Road, Evanston IL 60208.