Corporate Investment Decision Practices and the Hurdle Rate Premium Puzzle

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ABSTRACT

We survey a cross-section of 127 companies to gain insight on various dimensions of firms' investment decisions. The questions posed by our survey address the hurdle rates firms use, calculations of project-related cashflows, and the interaction of cashflows and hurdle rates. Unlike previous studies which examine investment decisions by either using survey data or data obtained from financial tapes, we use both sets of data jointly. This approach produces one of our primary findings that hurdle rates used by our sample of firms exceed their cost of capital that we calculate using Compustat and CRSP data by a substantial magnitude. Given the negative ramification of this finding regarding underinvestment, we investigate the determinants of this hurdle rate premium puzzle. We find that the hurdle rate premium is related to variables that measure financial flexibility, managers' confidence in the estimates of beta, financial health of firms, and the past performance of the industry they are in. Finally, survey firms do not have a good record in pairing hurdle rates and cashflows and they seem to have problems in some aspects of project cashflow computations.

Keywords: Investment decisions; hurdle rates; cost of capital; cashflows; survey

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I. Introduction

In this paper, we discuss our findings from a survey that covers a comprehensive list of discount rate and cashflow related issues concerning firms' investment decisions. Previous surveys typically focus on topics such as the popularity of different capital budgeting techniques, the extent to which firms rely on CAPM in determining their discount rates, whether multi-divisional firms use divisional or firm-wide hurdle rates, and how frequently firms change their hurdle rates.[2] Our survey respondents by and large confirm the findings of earlier studies on these issues.[3] For this reason, we do not report these results in this paper. Instead, we focus on investment decision practices that have not been examined by previous studies.

First, we examine the discount rates firms use in their investment decisions. We document that hurdle rates firms use in practice exceed their weighted average cost of capital (WACC) by a substantial margin, i.e., there appears to be a hurdle rate premium puzzle. Second, given the implication of this finding that firms may suffer from underinvestment, we explore the determinants of this puzzle. Third, we examine cashflow related issues, as well as the interaction between cashflows and discount rates. For example, we examine whether or not firms compute their cashflows correctly, whether or not they are consistent in matching project cashflows (levered versus unlevered) with the appropriate discount rates, and whether or not they correctly account for inflation in their investment decisions. We also probe survey participants about other cashflow topics such as how they handle sunk costs and how they account for erosion in sales of existing products that may be caused by the introduction of new competing products. Furthermore, we examine whether firms correctly analyze their cross-border projects in terms

[2] See for example, Graham and Harvey (2001), Bruner, Eades, Harris, and Higgins (1998), Poterba and Summers (1995), Trahan and Gitman (1995), and Bierman (1993).

[3] The primary findings of the earlier surveys are as follows: First, over time, firms have shown an increasing tendency to rely on discounted cash flow (DCF) methods to evaluate projects. Second, most firms apparently use their weighted average cost of capital (WACC) as the discount rate in evaluating their projects. Third, it seems to be the case that in computing their discount rates, firms typically infer the cost of equity from the capital asset pricing model (CAPM). Figure 1 displays the increased usage of these models and techniques over time.

of the currency denomination of hurdle rates and estimated cashflows. We spend most of our time on the hurdle rate premium puzzle because we regard this as the most significant contribution of the paper.

The survey was completed by the CFOs of 127 companies in October 2003. A high percentage of firms (106 of the 127 respondents) reveal their identity. For these firms we are able to match survey data with data from CRSP and Compustat. Many studies examine corporate decisions by using data obtained from financial tapes. The advantage of such data is that it is objective and it provides a substantial number of observations, which increases the level of confidence regarding the accuracy of the results. However, such data has also some shortcomings. Since models of financial decisions posit how managers *should* behave, ideally, the predictions of these models should be tested with data that reflects the *behavior* of the managers. However, data from financial tapes only partially reflects how managers behave since these data points represent realizations of financial variables which are jointly determined by the behavior of managers, the behavior of other economic agents, as well as by the parameters of the exogenous environment.[4] Thus, tests that use data contained in financial data bases may reveal whether a particular investment decision was a success or a failure *ex-post*, but they do not necessarily fully capture whether the success or failure of the project is the result of the procedures managers followed *ex-ante*. Survey data has its own strengths and weaknesses. While the behavior of agents is more likely to be captured directly, surveys typically do not produce a large number of data points. Additionally, if survey questions are not phrased carefully, tests based on survey responses could be misleading.

Comparing the hurdle rates of firms with their WACC is one of the key issues discussed in this paper. This issue can only be examined by combining survey data (to measure hurdle rates) with financial data bases (to compute WACC of firms).[5] Furthermore, both sets of data are also needed in examining the determinants of the potential discrepancy between hurdle rates and WACC.

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[4] For example, the realized level of sales of a firm does not only reflect how successful managers were in their past investment decisions, but it also reflects factors such as the current state of the economy, changes in consumer tastes, investments of competitors, etc.

[5] With the exception of Poterba and Summers (1995), earlier survey based studies would not be able to use information contained in publicly available data to examine investment decisions of firms since they do not know the identity of survey firms.

Our empirical findings on hurdle rates are as follows. First, based on our computations it appears that there is a hurdle rate premium puzzle. We find that hurdle rates we obtain from our survey data exceed, on average, the firms' cost of capital that we compute from financial data bases by a substantial magnitude (5.3% to 7.5%, depending on the equity premium assumption we use). Hurdle rate premiums in this range represent about one third to one half of the hurdle rates used by our sample firms. Poterba and Summers (1995) comment that hurdle rates of their survey firms appear to be too high. However, they do not document its size or explain its determinants. To our knowledge, this paper represents the first study that documents the actual size of the hurdle rate premium and explores its determinants. The substantial size of the hurdle rate premium puzzle we document is also supported by the views expressed by some investment bankers.[6]

Second, when we examine the determinants of this puzzle, we find that firms' growth opportunities (positively correlated with the hurdle rate premium), desire for financial flexibility (positively), financial health of firms (positively), and managers' confidence regarding their estimated betas (negatively), are important determinants of the hurdle rate premium. Furthermore, adjusted R-squares that are in the range of 0.40 to 0.44 suggest that the variables we use explain a substantial portion of the variation in hurdle rate premiums. Third, our results show that self-reported hurdle rates are related to firms' systematic risk, implying that firms use CAPM. However, our tests indicate that unsystematic risk also plays some (albeit lesser) role in the determination of their discount rates.

Our findings on the cashflow component of investment decisions and the interactions between cashflows and hurdle rates are as follows. First, two-thirds of the survey firms correctly incorporate inflation when evaluating projects. Second, they also seem to successfully handle the complex problem of domestic/foreign currency denominations of cashflows and hurdle rates in cross-border projects. Third, on the negative side, firms in our survey have somewhat of a mixed record on the computation of

[6] For example, in a roundtable discussion on capital structure and payout policy, Jon Anda, from the investment banking division of Morgan Stanley, states that "my feeling is that a large number of companies today are using hurdle rates that are well above their weighted average cost of capital" (see Smith, Ikenberry, Nayar, Anda and McVey (2005, p. 52)). Additionally, Antill and Arnott (2004) claim that the hurdle rates of the twelve oil companies they examine exceed their WACC.

cashflows, and in matching cashflows and discount rates correctly. In particular, not all firms appear to correctly account for factors such as sunk costs and the erosion in the sales of existing products that may occur when new, competing products are introduced. Additionally, while in general firms calculate levered or unlevered cashflows correctly, a large fraction of the survey firms does not use the correct cashflow-discount rate combinations.

The remainder of the paper is organized as follows. We discuss survey design and sample characteristics in Section II. We present our findings on self-reported hurdle rates in Section III. Section IV presents our calculations of WACC for our survey firms. Section V documents the hurdle rate premium puzzle. To gain insight about this puzzle, in Section VI we estimate bivariate regressions for self-reported hurdle rates and for the hurdle rate premium, where we use two equity premium scenarios. We follow this analysis by examining the determinants of the hurdle rate premium in a multivariate regression framework where the explanatory variables are the statistically significant coefficients obtained from the estimation of the bivariate hurdle rate premium regressions. In Section VII, we discuss our findings about the cashflow dimension of investment decisions and the interaction between cashflows and hurdle rates. Finally, we present our conclusions in Section VIII.

Due to space constraints we are unable to report the full list of our findings. At times we discuss some of our results briefly and refer to "results not displayed here" or "unreported results." These results can be accessed at www.hec.ca/pages/iwan.meier.

II. Survey Design and Sample Characteristics

A. Questionnaire

In designing the survey we carefully followed the advice of experts in the fields of psychology and marketing. We designed the questions in such a way that we minimize the use of buzz words and names of models that are taught in a typical MBA course. For example, we avoid the term "cost of capital" in our questionnaire. Instead, the survey participants were asked questions on their "hurdle rates." Similarly, we tried to avoid using terminology such as "levered" and "unlevered" cashflows, but rather provided them with the definitions of the two types of cashflows from which to choose. It is a well documented observation in psychology, known as the social desirability hypothesis (see e.g. Singer and Presser (1989)), 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. Therefore, we did not want to prompt them by asking questions that contain technical buzz words.

The input from numerous finance academics helped to further improve the content of the questions. Additionally, in order to test the survey with practitioners, we invited six CFOs from the Chicago area to a focus group meeting on May 26, 2003. After filling out the survey, we discussed each question to assure that the wording was not ambiguous.[7] The survey was sent out together with a cover letter from the Dean Emeritus of the Kellogg School of Management, Donald Jacobs, along with a postage-paid return envelope on September 12, 2003, to a total of 4,600 CFOs of U.S. companies listed in the Compustat name file. We asked the participants to return the questionnaire within ten days. At the beginning of October we sent a follow-up mailing.

A high percentage of the respondents reveal their identity (83.5%). Almost all surveys are filled out completely and there is no decline in the number of responses towards the end of the four-page questionnaire. We have some evidence that the surveys were actually filled out by CFOs as we received a number of e-mails requesting an advance copy of the survey results and these mails came directly from the CFOs. In addition, many respondents provide elaborate comments to open questions. The survey responses appear to be accurate. For example, when we compare self-reported sales figures with the numbers retrieved from Compustat, we find that a reassuring 92.3% of the respondents checked the correct sales range.

[7] We also followed the guidelines on questionnaire design and focus group meetings provided by Gillman (2000) and Morgan (1988).

B. Sample Description

Figure 2 describes the characteristics of the 127 firms in our sample. Panel A shows the breakdown by industry. Similarly to previous surveys (e.g. Graham and Harvey (2001); Poterba and Summers (1995)), most firms in our survey belong to the manufacturing sector (41.7% of the sample).[8] Firms in the technology and energy/transportation sectors constitute 13.4% and 10.2%, respectively, of the sample. We excluded firms in the financial sector from the survey.[9]

Firm size measured by (self-reported) sales is below $100 million for 35.2% of the companies (see Panel B) and 31.2% of the responding firms report sales in excess of $1 billion. Other characteristics of survey firms are as follows: The majority of the firms (72.0%) have multiple product lines. Fourteen respondents (11.3%) are privately owned firms. The equity stake of senior management in the firm is 5% or less for half of the respondents (53.3%), and 1% or less for 13.1% of the 107 participants that answered this question. Appendix A.1 reports details on the profiles of the responding CFOs.

III. Self-reported Hurdle Rates

We first discuss the summary statistics on self-reported hurdle rates (Section A). In Section B, we examine what the survey participants claim their hurdle rates represent (i.e., whether is it their weighted average cost of capital (WACC), cost of levered equity, etc.). In Section C, for the few firms that use cost of equity as their hurdle rates, we describe how we convert cost of equity based hurdle rates to their WACC equivalents. After this conversion all self-reported hurdle rates reflect the survey participants' perception of their WACC.

[8] In a number of surveys the fraction of manufacturing firms is even more pronounced. For example, in Gitman and Mercurio (1982) this ratio is 93.8%, while in Gitman and Forrester (1977) it is 74%.

[9] Financial firms account for 15% of the respondents in Graham and Harvey (2001). Specifically, we exclude all finance and insurance companies with the major SIC code in the ranges 6000-6499, 6700-6799 and utilities, in order to exclude regulated firms. We also exclude health, education, social services, and museums (7200+). We 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).

A. Summary Statistics on Hurdle Rates

In the survey, we ask the participants for the nominal hurdle rate that they have used for a typical project during the two years preceding the survey date.[10] Table I displays summary statistics on self-reported hurdle rates for the sample of firms. The results show that the mean hurdle rate is 14.1% in nominal terms (the median is 14.0%).[11] None of the numbers is less than 5% and the maximum is 40%. Furthermore, the skewness coefficient of 1.7 indicates that the distribution is fairly symmetric, and the kurtosis coefficient of 9.6 confirms that the distribution is centered around the mean and the median. Adjusting for the average inflation of 2.2% during the two years preceding the survey date (January 2001 to December 2003)[12] produces an average real hurdle rate of 11.6%, which is close to the 12.2% real hurdle rate reported in the survey conducted by Poterba and Summers (1995).[13] Thus, the hurdle rates we document may not be sample specific.

B. What Do Hurdle Rates Represent?

Of the 117 firms that responded to the question on what their hurdle rate represents, a significant percentage of the CFOs (71.8%) claim that the hurdle rate they use is their weighted average cost of capital (WACC). Apparently, in the case of 7 firms (6.0%), the hurdle rate represents their cost of levered equity, while for 9 firms (7.7%) it reflects their unlevered cost of equity. For 17 firms (14.5%), the hurdle rate falls into the "other" category. The bar chart in Figure 3 illustrates these fractions. The widespread use of WACC in our sample is consistent with the findings of Bruner, Eades, Harris, and Higgins (1998) and Bierman (1993) who report that even larger fractions of firms use WACC. As displayed in Figure 1, it appears that similar to the increased use of discounted cash flow (DCF) techniques and CAPM, the use

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[10] The number of responses to this question is 119. Seven of the 8 non-responding firms do not use a discounted cash flow (DCF) technique as their primary capital budgeting method.

[11] If a range is provided instead of a single number, then we take the average (11 respondents). One observation is reported in real terms and we convert this rate to its nominal equivalent by using the average, annual inflation rate of 2.2% from 2001-2003.

[12] Inflation rates are based on the Consumer Price Index (CPI-U) compiled by the Bureau of Labor Statistics.

[13] While earlier surveys such as Gitman and Forrester (1977), and Gitman and Mercurio (1982), also report high nominal rates (14.1%, and 14.3%, respectively), the hurdle rates they report are not high in real terms, considering the double-digit rates of inflation that was in effect during the time of these two surveys.

of WACC has also increased over time. For example, in a survey conducted 30 years ago, Petty, Scott, and Bird (1975) document that only 30% of the Fortune 500 firms that responded to their survey use WACC. In contrast, in later surveys, such as the one by Eades, Harris, and Higgins (1998), this figure jumps to over 80%.

C. Converting Non-WACC Self-reported Hurdle Rates to WACC-based Self-reported Hurdle Rates

In 13.7% of the cases where survey participants indicate that they use either levered or unlevered cost of equity as their hurdle rate, we transform these cost of equity based hurdle rates to their WACC equivalents. If they indicate that the hurdle rate represents their cost of levered equity, we use this rate as the cost of equity and average it with their after-tax cost of debt and market value weights to compute their WACC. If they indicate that the hurdle rate represents their cost of unlevered equity, we check if they have any debt. Obviously, for the four firms that do not have any debt, their unlevered cost of equity and their WACC are identical. For firms with debt in their balance sheets, we lever up the reported cost of unlevered equity to obtain their cost of levered equity, and then compute their WACC using their after-tax cost of debt and market value weights. These procedures enable us to obtain WACC-based self-reported hurdle rates for 101 firms.

IV. WACC Computations for the Survey Firms

In this section, using data from CRSP and Compustat, we discuss how we compute the actual WACC for the survey firms. We start our WACC computations for the survey firms in Section A by calculating their cost of levered equity. In Section B, we discuss how we compute before-tax cost of debt, tax rates, and the weights for debt and equity.

A. Computing Cost of Levered Equity Using CRSP and Compustat Data

In recent years, as documented by Bruner, Eades, Harris, and Higgins (1998) and Graham and Harvey (2001), the dominant model that firms use in calculating their cost of equity has been the CAPM.

Graham and Harvey (2001) report that 73.5% of the firms in their survey use CAPM "always" or "almost always". Their findings also show that only a small number of firms implements more complex, multi-factor models. To determine whether or not our survey firms use CAPM, we did not ask questions about the components of CAPM directly in order to avoid the potential contamination of the data, as predicted by the social desirability hypothesis. Instead, we ask indirect questions such as whether or not their hurdle rates capture the sensitivity of project returns to macro economic changes, interest rate changes, etc. The responses indicate that the use of CAPM is widespread for our sample of firms. For example, 68.6% of our survey participants check the following statement as being important or very important; "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 hurdle rates.[14]

In calculating the survey firms' cost of equity, we chose proxies for the risk-free rate and the equity premium that are on the high side. We do this in order not to introduce a bias towards finding a hurdle rate premium. The mean life of a typical project for firms in our survey sample is 6.8 years. For this reason, we use the 10-year Treasury bond rate, which was 4.3% at the time of our survey, as a proxy for the risk-free rate.[15]

For the equity premium we first use 6.6% which represents the difference in the arithmetic average of the return on the S&P 500 index and the long-term Treasury bond rate covering the period 1926-2003 (obtained from Ibbotson (2004)). This value is similar to the 7% figure used by 226 financial economists in the survey conducted by Welch (2000). However, some studies argue that the equity premium is much lower. For example, using a forward-looking approach, Blanchard (1993), Wadhwani (1999), Jagannathan, McGratten, and Scherbina (2001), and Fama and French (2002) suggest that the

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[14] Other factors that survey participants consider to be "important" or "very important" are cyclical changes in the industry the firm operates in (53.8%), changes in corporate tax rates (40.8%), cyclical changes in the economy (35.3%), and political uncertainty (27.1%).

[15] This choice seems to be justified for other reasons as well: In their survey of 27 highly regarded corporations, Bruner, Eades, Harris, and Higgins (1998) find that more than 70% use a 10-year or longer-term Treasury rate as the proxy for the risk-free rate. They report that only 4% of the firms in their survey use the 90-day T-bill rate.

equity premium may be in the 3-4% range. The lower risk-premium figures in recent studies are based on data that shows that the equity premium has declined considerably during the nineties. For example, the 217 respondents to the Duke/CFO Magazine survey in December 2003 by Graham and Harvey (2005) expect, on average, a premium of the S&P 500 index over the 10-year T-bond yield of 3.83% (the median is 3.60%). Since this figure is obtained from a survey of CFOs that was conducted about two months after we mailed our questionnaire, it may be close to the actual equity premium used in practice at the time of our survey. For this reason we repeat our analysis using this lower (3.6%) equity premium.

Beta coefficients for individual firms are often difficult to estimate. We obtain beta from the slope coefficient of the market model that we estimate. Since beta coefficients tend to be not very robust, we corroborate our results by calculating betas using various alternative estimations. These estimates involve different combinations of data frequencies (daily, weekly, and monthly), lengths of sample periods, and weighting schemes (in the case of industry betas). These estimation procedures are explained in Appendix A.2.

Table II displays the summary statistics for the beta coefficients estimated by using the methods described in Appendix A.2. Pairwise simple correlations of estimated beta coefficients (not reported here) are relatively high, ranging from 0.55 to 0.90. The same conclusion holds for the Spearman rank order correlation. Nevertheless, given that there is some dispersion in the estimated beta coefficients, calculating WACC and hurdle rate premiums on the basis of different beta estimates may be informative since it provides a robustness check.

When market models that might suffer from potential noise problems (models that use weekly observations and daily observations without lags) are excluded, the mean values of the beta coefficients estimated from the remaining models (1), (2), (5), (6), and (7) range from 0.93 to 1.03. We include model (5) since under this estimation procedure the four lagged variables in the market model alleviate the problem of stale prices. Based on the estimated beta coefficients from these five models it appears that our survey firms are fairly representative of the market. In the empirical tests we conduct, we report results where beta is estimated from the market model using monthly returns over a five year period, i.e.

Method (1). We choose this particular method since it is most commonly used in empirical studies. It also forms the baseline model for most service beta providers. Results not reported here show that for the survey firms, the estimated means of cost of equity using the five models mentioned above range from 10.42% to 11.07% under the assumption of a 6.6% equity premium. The mean of the cost of equity based on the beta estimate from Method (1) is 10.42% (the median is 9.76%). When the lower equity premium of 3.6% is used the mean values for the cost of equity estimates range from 7.64% to 7.99%, and the mean for Method (1) is 7.64% (the median is 7.28%).

B. After-tax Cost of Debt, Debt/Equity Weights and the WACC Computations

For the before-tax cost of debt we use the survey participants' answers to our question regarding what the interest rate on their senior debt is.[16] The survey provides data on the before-tax cost of debt of 88 firms. Using Compustat data, we check whether firms that left the interest rate question blank had any debt. Out of the 39 non-responding firms we can match Compustat data for 28, and 16 of these firms turn out to have no debt. For these firms WACC and cost of unlevered equity are identical. However, our check also reveals that 12 firms had debt even though they left the interest rate question blank.[17] For these firms we use their Altman's Z-score to assign interest rates. If a firm's Z-score is greater than 3, a score that indicates a very low probability of default (8 firms), we assign the 10-year Treasury bond rate in effect at the time of the survey plus 1 percent (5.3%). For the two firms with Z-scores of less than 1.81 (financially unhealthy firms), we assign the 10-year Treasury rate plus 4 percent (8.3%). Firms that have Z-scores in the interval between 1.81 and 3 (2 firms) are assigned a before-tax cost of debt of 6.3%. Given the narrow default risk spreads at the time of the survey, the assumptions we employ are likely to exaggerate the cost of debt of the 12 firms in question and thus, if anything, introduce a bias against

[16] We do not know whether their answers refer to the coupon rate or the yield to maturity of their senior bonds. Thus, for firms that have not issued debt recently, it is possible that their answers do not reflect the marginal cost of debt if they report coupon rates. However, given the secular decline of interest rates that started in the late 1990s and continued during the early 2000s, this should work against finding a hurdle rate premium.

[17] Out of these 12 firms, 2 have less than 1% debt (as a fraction of market value of assets) and another 6 less than 5%.

finding a hurdle rate premium. Finally, for firms that report a rate below the 10-year Treasury rate (4.3% at the time of the survey) we add a spread of 0.5% to the Treasury rate. Therefore, all our WACC calculations assume cost of debt of at least 4.8%.

We calculate a firm's tax rate by dividing total income taxes (Compustat item #16) by income before taxes (#170). When item #16 or #170 is negative (tax credits and negative profits, respectively), we set the tax rate to zero. Finally, we cap the tax rate at 34 percent.[18]

To compute the weight of debt, we divide total debt (the sum of Compustat items #9 and #34) by total debt plus market value of equity (the product of number of shares (#199) and end of year stock price (#25), plus the book value of preferred stock (#130)). For the weight of equity we use (1 – weight of debt). Due to lack of data on target capital structures, we assume that the current capital structure of survey firms is also their target capital structure. In our survey sample, 30.1% of the firms report that they do not plan to change their capital structure during the next three years, while 24.4% were planning on having higher leverage, and 45.5% had the intention of using less debt in the future. Given the numbers above, it appears that using the current capital structure weights as proxies for target rates is not likely to bias our WACC computations.

The summary statistics of computed WACC using the beta estimation methods (1), (2), (5), and (6) are reported in Table III for the two equity premium scenarios (Panels A and B).[19] We are able to obtain computed WACC for 83 firms for which we have matching Compustat and CRSP data. The mean values for the nominal, computed WACC under the 6.6% (3.6%) equity premium assumption range from 9.30% to 9.55% (7.18-7.31%). These nominal mean rates correspond to real rates of 6.95% to 7.19% (4.87-5.00%). The arithmetic average of the four different costs of capital calculations is 9.45 (7.26) in nominal terms and 7.09 (4.95) in real terms. Skewness and kurtosis statistics for the various WACC calculations indicate that the distributions of WACC are symmetric and that the observations are centered on means and medians.

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[18] The tax rate we obtain in this manner reflects a firm's average and not marginal tax rate. However, we were unable to obtain a sufficient number of observations on marginal tax rates.

[19] We do not include model (7) since it is the weighted average of models (1) and (6).

V. Documenting the Hurdle Rate Premium Puzzle

The summary statistics on the hurdle rate premium (self-reported hurdle rate – computed WACC) under the 6.6% and 3.6% equity premium assumptions, using the same four beta estimation methods as before, are displayed in Table III. These results show that the hurdle rates used by our survey firms exceed their WACC that we compute using CRSP and Compustat data. Under the 6.6% (3.6%) equity premium scenario, the hurdle rate premium ranges from 5.11 to 5.28% (7.33-7.45%).[20] For Method (1), columns 2 and 6 show that the mean (median) hurdle rate premium is 5.28% (5.23%), and 7.45% (6.90%) for equity premiums of 6.6% and 3.6%, respectively. The magnitude of the hurdle rate premium is substantial. Given that the mean self-reported hurdle rate is 14.1%, the mean hurdle rate premium is more than half of the mean hurdle rate used by managers when the equity premium is assumed to be 3.6% and more than a third of the mean hurdle rate when the equity premium is assumed to be 6.6%. Results not reported here show that even when for each firm the maximum of the computed WACC figure is used (Method (8) of Table II), the hurdle premium is still large (3.04% and 6.22% for equity premiums of 6.6% and 3.6%, respectively). Furthermore, any doubt about the presence of the hurdle rate premium is dispelled when the computed cost of levered equity (using the maximum of the beta estimates) rather than computed WACC is compared with self-reported hurdle rates. Even in this case the hurdle rate premium is still positive with means of 1.59% and 5.60% for the higher and lower equity premium assumptions. Since cost of equity represents the upper bound of cost of capital, the fact that hurdle rates exceed even the more expensive component of computed WACC (even when cost of equity is calculated with the maximum beta), provides strong evidence that hurdle rates used in practice are significantly higher than those rates predicted by theory. Figure 4 plots the distribution of the hurdle rate premium.

[20] When beta coefficients are estimated using all specifications of the market models reported in Table II (Models (1) to (7)) the hurdle rate premium ranges from 4.68-6.06% when the equity premium is assumed to be 6.6% and 7.12-7.84% when the 3.6% equity premium is used.

VI. Investigation of Hurdle Rates and the Hurdle Rate Premium Puzzle

In this section, we empirically examine the variables that could explain the hurdle rates and the hurdle rate premium puzzle that we documented in the previous section. Section A reports the results for the self-reported hurdle rates. In Section B we investigate the hurdle rate premium puzzle by running bivariate regressions for the hurdle rate premium under the 6.6% and 3.6% equity premium scenarios. In Section C we analyze the hurdle rate premium by estimating multivariate regressions where the explanatory variables are those that are statistically significant at the 5% level in the bivariate regressions. The multivariate regressions enable us to see to what extent we are able to explain the hurdle rate premium puzzle and to assess whether the explanatory variables of the bivariate regressions retain their sign and statistical significance in the multivariate setting.

The explanatory variables we use in examining both, the hurdle rates and the hurdle rate premium, fall into seven general categories: measures of risk (beta, standard deviation of stock returns, measures of systematic and unsystematic risk), variables that are designed to capture firms' growth opportunities (market-to-book ratio, average industry returns during the five years prior to the survey), variables related to financial flexibility (cash-to-assets ratio, debt-to-assets ratio), variables related to firms' financial health (Altman's Z-Score and the current ratio), firm size (log of assets and log of sales), variables that reflect the survey participants' views regarding whether or not their firms are financially and/or managerially constrained, and finally, the level of confidence managers have regarding their beta estimates. We measure managers' confidence regarding their betas by the goodness of fit of the market model. The reason for including this variable in the analysis is that, while we find strong evidence that firms in our sample use CAPM in determining their cost of equity, it is possible that managers make subjective adjustments to their estimated cost of equity when they lack confidence in the beta estimates obtained from the market model.

A. Explaining the Hurdle Rates: Bivariate Regressions

We report our results on hurdle rates and the hurdle rate premium in Table IV. As can be seen from column 3, self-reported hurdle rates are positively correlated with computed WACC. This result confirms the survey participants' claim that the hurdle rates they use represent their WACC. Hurdle rates are also positively related to beta, total risk (standard deviation of monthly stock returns during the five years prior to the survey date), and to both systematic and unsystematic risk measures. The estimated coefficients are significant at the 1 percent level, with the exception of the beta coefficient which is significant at the 5 percent level. The positive correlation of hurdle rates with systematic risk suggests that firms indeed use CAPM in setting their hurdle rates. The positive coefficient for total risk could be driven by its systematic or unsystematic risk component or some combination of the two.

Since beta is an index of systematic risk, while the standard deviation of stock returns measures the total risk, the estimated coefficients for these two variables are difficult to compare. To make the comparison meaningful, we measure systematic risk by $\beta_i \sigma_m$ and unsystematic risk by $\sqrt{\sigma_i^2 - \beta_i^2 \sigma_m^2}$. The results indicate that, independent of how it is measured, systematic risk is an important determinant of hurdle rates. Even though this result suggests that managers use CAPM, it seems that they also incorporate unsystematic risk in their hurdle rates.[21] This result is in contrast with the findings of Poterba and Summers (1995) who, after finding that in their sample neither systematic nor unsystematic risk is related to self-reported hurdle rates, comment that "a striking conclusion is that none of the traditional financial variables that may proxy for risk, like the firm's stock market beta, correlates with hurdle rates." In our sample, judging by the relative size of the coefficients (the estimated systematic risk coefficient is twice as big as the unsystematic risk coefficient) it appears that managers consider systematic risk to be more important than unsystematic risk. To further examine the relative importance of the two risk variables we estimate a regression of hurdle rates on both, systematic and unsystematic risk. Results not

[21] There is some evidence in the recent literature that unsystematic risk plays a role in determining the required rate of return of investors. See for example, Goyal and Santa-Clara (2003), Barberis and Huang (2001), and Malkiel and Xu (2001).

displayed here show that when systematic risk is accounted for, the t-statistic for the unsystematic risk coefficient drops from 3.16 in the bivariate regression to 2.02 in the trivariate specification. However, the adjusted R-squares increases from 0.09 in the bivariate systematic risk regression to 0.14 when both risk measures are included. These results suggest that while systematic risk plays a more important role in hurdle rates, unsystematic risk still has some incremental explanatory power. Survey results also support the relative importance of systematic risk over unsystematic risk. When the CFOs are asked to judge the importance of systematic and unsystematic risk in the determination of their hurdle rates (we do not use these terms in the survey questions), the responses indicate that they consider systematic risk to be more important than unsystematic risk.[22]

The self-reported hurdle rates are also correlated with non-risk variables. They are positively related to the average 5-year industry returns, the current ratio, and the binary variable "risk adjustment to hurdle rates" (1 if a firm adjusts hurdle rates for risk, 0 otherwise) at the 5% significance level, and to cash-to-assets at the 1% significance level. On the other hand, hurdle rates are negatively related to debt-to-assets (at the 5% significance level) and the median R-squares of the market model of the two-digit SIC industry that the survey firms belong to (at the 10% significance level). In sum, while Poterba and Summers (1995) find only the current ratio to be related to the hurdle rates, we find that in addition to the firms' liquidity ratio, financial flexibility considerations (cash-to-assets and debt-to-assets) and past performance of the industries that survey firms belong to are also important in explaining self-reported hurdle rates. Since we find that most of these variables appear to be also important in explaining the hurdle rate premium, we postpone our interpretation of these statistically significant coefficients to sections C and D.

[22] On a scale from -2 (not important) to 2 (very important), the mean score regarding the importance participants attach to the sensitivity of project returns to economic conditions is 0.86. On the other hand, the response to the importance of project risk that is unrelated to the state of the economy has a mean score of 0.68. Furthermore, 68.8% of the firms consider the former type of risk to be "important" or "very important", while the figure for the latter type of risk is 60.9%.

C. Determinants of the Hurdle Rate Premium: Bivariate Regressions

Column 6 of Table IV shows that systematic risk variables (beta and $\sqrt{\sigma_i^2 - \beta_i^2 \sigma_m^2}$) and the computed WACC are negatively correlated with the hurdle rate premium when the equity premium is assumed to be 6.6%. However, these negative relationships may simply arise from the definition of the hurdle rate premium. Cost of equity and WACC increases when a higher equity premium is assumed. Since the hurdle rate premium is defined as self-reported hurdle rate minus computed WACC, the higher is the equity premium assumption the lower is the resulting hurdle rate premium. Thus, the significantly negative correlations between the hurdle rate premium and both WACC and systematic risk may be an artifact of a higher equity premium assumption (6.6% versus 3.6%). As expected, the binary variable that reflects whether firms account for risk by adjusting hurdle rates (1 if they do and zero otherwise) is positively correlated with the hurdle rate premium.

The results in Table IV also show that hurdle rate premium is positively correlated with variables that measure a firm's growth opportunities (market-to-book ratio and past industry returns), financial flexibility considerations (positively related to cash-to-assets and negatively related to debt-to-assets), proxies for firms' financial health (current ratio and Altman's Z-score), and negatively correlated with the precision of its estimated beta. Debt-to-assets and current ratio are significant only under the 3.6% equity premium assumption.

The most frequently used growth opportunities proxy in the literature is the market-to-book ratio. This variable is positively correlated with the hurdle rate premium under both equity premium assumptions. This result is consistent with the hypothesis that high growth firms behave in a more discriminating manner and, hence, use higher hurdle rates in choosing projects. We also use the past performance of firms as an alternative proxy for growth opportunities and also to see whether past stock returns influence investment decisions in the current period. In order to prevent outliers from affecting the estimates, we use the median industry (two-digit SIC code) returns over the past five years instead of the return of the individual firms over the same time period. To the extent managers subscribe to the notion that high growth opportunities experienced by their industry in the past are indicative of similarly rich growth opportunities in the future, they may evaluate projects at a higher discount rate relative to firms which experienced a mediocre performance during the recent past.

Using hurdle rates that are higher than their WACC may indicate that managers pass up on some good projects in the current period in the belief that projects that approach the high returns of the past are just around the corner. Of course, if the highly positive NPV projects of the past do not materialize in the future, using hurdle rates that are "too high" in the current period represents *ex-post* a destruction of value. In fact, it is possible to put an even more pessimistic interpretation to the relationship in question. If firms that have earned high returns in the past use these returns as the benchmark for future investments, managers may dismiss a valuable project even when its return exceeds the WACC since accepting projects that do not clear their benchmark lower their average return. If managers behave with the misconception that investors are focused on high past returns rather than whether or not a particular project clears the firm's WACC, they would be sacrificing potential value by underinvesting.

We use cash-to-assets and debt-to-assets to assess whether financial flexibility considerations can explain hurdle rate premiums. Firms which consider financial flexibility to be important typically have high cash-to-assets and low debt-to-assets ratios. Growth firms value financial flexibility and preserve leverage capacity by holding excess cash and by under-borrowing in order to be able to exploit future growth prospects. We do not know what fraction of a firm's cash is excess cash and what the borrowing capacity of a given firm is. However, there is some evidence that supports the view that high cash-to-assets and low debt-to-assets proxy for firms' desire for financial flexibility. For example, Opler, Pinkowitz, Stulz, and Williamson (1989) report that firms with rich growth opportunities hold relatively high cash-to-assets ratios. The finding of Opler et al. (1989) appears to hold for our survey firms as well. When we regress cash-to-assets on growth opportunity proxies (market-to-book, average 5-year industry returns) we find that the estimated coefficients are positive. We find that the same conclusion holds for debt-to-assets. When we regress this variable against the growth opportunity proxies discussed above, both estimated coefficients are negative and statistically significant (p-values are 0.023 and 0.015 for market-to-book and average 5-year industry returns, respectively). Thus, it appears that for our survey firms high cash holdings are positively correlated with excess cash and that low debt ratios are positively correlated with unused debt capacity.

We next examine two variables that reflect a firm's financial health; the current ratio and Altman's Z-score. The current ratio measures a firm's financial health from the perspective of its liquidity. While we find that the current ratio is not strongly related to the hurdle rate premium, the Z-score, which measures a firm's overall financial health in the context of its default risk, is positively correlated with the hurdle rate premium calculated under both equity premiums.[23]

Finally, the results displayed in Table IV show that under both equity premium assumptions there is an inverse relation between the hurdle rate premium and the median R-squares of the market model for firms in the same industry (two-digit SIC code) as the survey firms.[24] The coefficients are statistically significant at the 1% level. Why would the hurdle rate premium increase as the goodness of fit of the market model becomes poorer? A possible explanation of this result is that when the goodness of fit of the beta estimate is poor, managers feel less confident that their estimated beta reflects their "true" beta.[25] If this indeed is the case, they might be reluctant to use CAPM in a mechanical manner, but instead make subjective adjustments to their CAPM-based cost of equity. Given risk-aversion considerations, to be on the safe side, these adjustments appear to be in the direction of using higher hurdle rates rather than lower rates.

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[23] The Z-score is not considered to be linearly related to a firm's default risk. Instead, firms with a Z-score below 1.81 are considered to be financially unhealthy, while Z-scores in the range of 1.81 and 3.0 are thought to represent firms that are partially healthy, and Z-scores above 3.0 are associated with financially healthy firms. For this reason, we use Z-scores to construct a categorical variable with those three categories.

[24] This negative relationship also holds if we use the R-squares of the market model of the individual survey firms instead of the median R-squares of the market models of all firms that are in the same industries as the survey firms (in fact the p-value is even lower). In order to eliminate the possibility that outliers may disproportionately affect the estimates, we use the median R-squares for each industry. The survey firms belong to 29 different two-digit SIC codes. For each two-digit SIC code we have between 7 and 899 firms in the CRSP database with a mean of 156 firms.

[25] It can be argued that low R-squares obtained from the market model reflect a high degree of unsystematic risk rather than lack of precision of the estimated beta. However, as can be seen in Table IV, the estimated coefficients for unsystematic risk variable are not statistically significant in the hurdle rate premium regressions under both equity premium assumptions. This suggests that R-squares of the market model proxies for the precision of beta estimates.

C. Determinants of the Hurdle Rate Premium Puzzle: Multivariate Regressions

We next specify multivariate models for the two equity premium assumptions we employ and allow statistically significant variables (at the 5% level) from the bivariate regressions to compete against each other in explaining the hurdle rate premiums. This enables us to see if the statistically significant explanatory variables in the bivariate regressions continue to have the expected signs and continue to be statistically significant in a multivariate setting. We repeat our multivariate analysis using stepwise regressions.

Models (1) and (3) of Table V display the multivariate regression results. The difference between Models (1) and (3) is the equity premium assumption. Models (2) and (4) display the estimates obtained from step-wise regressions that exclude variables that do not contribute towards an increased adjusted R-squares. For the step-wise regression procedure, we set the significance level for removal from the model at 0.20. Since the coefficient for unsystematic is not significant in the bivariate regressions and since the two measures of systematic risk are perfectly correlated, we use $\beta_i \sigma_m$ as the only risk variable.

Estimates obtained from Model (1) indicate that none of the signs of the significant coefficients of the bivariate regression estimates are reversed. However, the estimated coefficient for the market-to-book ratio becomes statistically insignificant possibly because this growth opportunities proxy is correlated with the other growth proxy we use in Model (1) (the average 5-year industry return). The corresponding step-wise regression estimates are displayed in Model (2). The adjusted R-squares increase from 0.41 to 0.44.

Unlike Model (1), the regression in Model (3) does not include systematic risk because under the 3.6% equity premium scenario this variable is not statistically significant in the bivariate regression. On the other hand, Model (3) includes debt-to-assets, current ratio, and the binary variable that reflects whether or not managers adjust their hurdle rates for risk as explanatory variables since these three variables are statistically significant in the bivariate regressions when the equity premium is assumed to be 3.6%. Since none of these variables turn out to be statistically significant in Model (3), the step-wise procedure drops them from the estimation. The resulting adjusted R-squares increases from 0.21 to 0.42. These results show that essentially the same set of variables contributes towards explaining the hurdle rate premium puzzle under both equity premium assumptions. In sum, variables that measure growth prospects and firms' financial flexibility are positively, and the goodness of fit of the market model is negatively correlated with the hurdle rate premium (systematic risk is also positively correlated under the higher equity premium assumption). Furthermore, neither the explanatory power of the regressions nor the sign and the statistical significance of the coefficients appear to be sensitive to the equity premium used. Finally, judging by the adjusted R-squares it appears that the variables we use explain a significant portion of the variation in hurdle rate premium.

VII. Cashflow Related Practices and Interactions between Cashflows and Hurdle Rates

Surveys about investment decisions typically focus on capital budgeting methods and hurdle rate related issues, such as whether or not firms use CAPM. Even though in making investment decisions managers use both hurdle rates and cashflows as inputs, earlier studies typically do not analyze the cashflow dimension of investment decisions and they do not investigate whether firms take into account the interactions between project hurdle rates and cashflows. For example, we are not aware of surveys that investigate how firms incorporate inflation, sunk costs, and sales erosion in existing projects caused by new product introductions into their analysis. Similarly, previous surveys do not investigate whether firms employ the correct definitions of levered or unlevered cashflows, and whether firms use the correct cashflows/discount rate combinations. One of the contributions of this paper is that we fill these gaps. In Section A, we discuss our survey results on cashflows related issues. In Section B we turn our attention to the interaction between cashflows and hurdle rates, and how firms account for inflation in evaluating projects.

A. Calculation of Cashflows, Sunk Costs, and Cannibalization of Existing Product Sales

Table VI shows that in evaluating projects, 45.5% of the firms compute cashflows as earnings before interest and after taxes (EBIAT) + depreciation – capital expenditures – net change in working capital (i.e., unlevered cashflows). Levered cashflows, which are defined as net income + depreciation – capital expenditures – change in net working capital, are the next popular cashflow measure (25.2% of the survey firms use it). 16.3% of the firms apply an incorrect "unlevered cashflow" definition by not subtracting fixed and current assets investments. Overall, about 71% of the firms employ correct definitions of either levered or unlevered cashflows while the remaining 29% of the survey firms define cashflows incorrectly. Needless to say, firms may rely on either levered or unlevered cashflows in evaluating projects, provided that they use the correct cashflows and discount rate combinations. We examine this issue in Section B.

Table VII displays how the survey firms handle the loss of sales in existing products when new competing products are introduced (cannibalization or erosion), and sunk costs. Survey participants are asked whether or not they subtract expected losses in the sales of existing products caused by new competing product introductions in evaluating new projects. This question was answered by an unequivocal "yes" by 81.3% of the respondents, while only two respondents (1.8%) qualify their answer by checking the option that they would do so only if their competitors are unlikely to introduce similar products. Sixteen firms (14.3%) indicate that they would never account for erosion in forecasting the sales of new products. Given the highly competitive nature of U.S. industries, it is surprising that 81.3% of the firms indicate that they would forecast sales for new products as if there are significant economic, technological, or legal barriers to entry.[26]

[26] Due to patent protection in certain industries such as the pharmaceutical and technology sectors, firms would be justified not to account for sales erosion of existing products in introducing new competing products for the duration of their patents. However, given that 41.7% of our survey firms are in the manufacturing sector and an additional 10.2% are engaged in energy/transportation industries, the fact that 81.3% of the survey firms behave as if competitors would be unable to introduce similar products seems difficult to justify.

Table VII also displays how firms treat sunk costs. We address this topic with the following question: "In valuing projects, do you incorporate into the cashflows the money you spent before making accept/reject decisions?" Surprisingly, 52.4% of the respondents answer this question affirmatively.

B. Interactions between Cashflows and Hurdle Rates and how firms account for inflation

As we discussed above, 71% of the firms use the correct definitions of either levered or unlevered cashflows. In this section, we first examine whether or not these firms match the cashflows they use with the appropriate discount rate. The intersection of two survey questions on cashflows and hurdle rates is displayed in Table VIII. While 71.3% use WACC as their hurdle rate and 44.4% of the firms use unlevered cashflows, only 34.8% of the firms use the correct combination of unlevered cashflows and WACC in evaluating investment projects. Nineteen percent of the respondents apparently make the mistake of discounting levered cashflows at their WACC. Furthermore, while 25.2% of the firms use levered cashflows, apparently only one of these firms discounts levered cashflows at the levered cost of equity.

We next investigate how firms account for expected inflation in their investment decisions. The results are displayed in Table IX. In the questionnaire, we deliberately did not pair nominal/real hurdle rates and cashflows in the same question. Instead, we asked whether they use nominal/real discount rates and nominal/real cashflows in two separate questions. In fact, the two questions were in different sections (and different pages) of the questionnaire. We did this to minimize the possibility that the participants may pick the correct answer by guessing that discount rates and cashflows must be measured in a consistent manner (i.e., both needs to be either nominal or real). The table shows that 41.3% of the respondents use nominal cashflows and 49.6% use nominal hurdle rates. However, the table also shows that 29.8% of the respondents correctly match nominal hurdle rates with nominal cashflows. Similarly, while 58.7% of the respondents rely on real cashflows and 50.4% employ real hurdle rates, the real hurdle rate/real cashflow combinations represent 38.4% of the answers. Overall, 68.2% of our survey firms correctly incorporate inflation into their analysis.

The survey also contains questions on cross-border investments. One question is about the risk of domestic projects compared with similar foreign projects. Half of the respondents (50.9%) consider foreign projects to be riskier than similar domestic projects. It also appears that these firms account for this incremental risk differently: About two thirds of these firms (68.9%) use higher hurdle rates in cross-border projects than they do in similar domestic projects, while one third (31.1%) use more conservative cashflow projections to deal with the higher risk of foreign projects. The survey results also show that 90.4% of the firms handle the currency denomination of cashflows and hurdle rates of cross-border investments correctly: 50.0% of the firms indicate that they evaluate both foreign project cashflows and hurdle rates in dollar terms, while 40.4% claim that they use foreign currency-denominated cashflow and hurdle rates.[27]

Finally, our survey addresses two additional topics on hurdle rates. First, we find that during the three years preceding the survey date 52.5% of the firms have not changed their hurdle rates.[28] Second, a surprising 80.3% of the survey firms with multiple divisions "always" or "almost always" use firm-wide hurdle rates. Distortions in the form of over- and underinvestment resulting from not changing hurdle rates when warranted by changes in market conditions and the use of firm-wide hurdle rates by multi-divisional firms are well documented.

VII. Conclusions

In this study we investigate how firms make investment decisions. Unlike previous studies which use either survey data or data obtained from financial tapes such as CRSP and Compustat, we use both

[27] The survey also includes standard questions regarding the use of capital budgeting methods. Our results confirm the findings of earlier surveys that firms use, by a wide margin (87.5%), discounted cash flow (DCF) methods, and that DCF use increases with firm size. Since these stylized facts are widely known, we do not report our results on this issue.

[28] Another 24.5% changed their hurdle rates once and the remaining 23.0% changed their hurdle rates more than once. While Brigham (1975), Gitman and Mercurio (1982), and Bruner, Eades, Harris, and Higgins (1998) provide similar evidence that a relatively low portion of U.S. firms schedule reviews of their hurdle rates with some regularity, apparently, the practice in other countries is even worse. According to an article in *The Economist* ("How high a hurdle?", May 8, 1999), the corporate practices on this issue are worse in Europe. The article argues that "while U.S. firms often review their hurdle rates, in continental Europe they do so sometimes, and in Britain, rarely."

sets of data. Combining the two sources of data enables us to examine three main topics that are typically not addressed in previous survey studies. First, since a significant fraction of survey firms claim that the hurdle rates they use represent their WACC, we compare hurdle rates firms use in practice with what they should use based on theory. We show that hurdle rates used by survey firms exceed their computed WACC by a wide margin (5.3% to 7.5%), i.e., there appears to be a hurdle rate premium puzzle. These hurdle rate premium figures are substantial – representing one third to one half of the hurdle rates used by our survey firms.

Second, after documenting that there is a significant wedge between self-reported hurdle rates and the textbook version of WACC, we explore the determinants of this hurdle rate premium puzzle. Our results show that the hurdle rate premium is positively correlated with high growth opportunities, firms' desire for financial flexibility, and the financial health of firms, and negatively correlated with the goodness of fit of the market model. It appears that these variables explain a significant fraction of the variation in the hurdle rate premium. While Poterba and Summers (1995) surmise that the hurdle rates they obtain from their survey are on the high side and some practitioners express the view that firms tend to use hurdle rates that exceed their WACC, to our knowledge, this is the first study that documents the actual size of the hurdle rate premium and explores its determinants. Given that firms may be sacrificing potential value by aiming at returns that are "too high", we consider showing the existence and the size of hurdle rate premium, and uncovering some of the important variables that explain the hurdle rate premium puzzle to be the most important contributions of this paper. Since our results have severe underinvestment implications, our view is that the presence and the determinants of the hurdle rate premium need to be examined further in future research.

Third, we address issues relating to the cashflow component of investment decisions and examine cashflow/hurdle rate interactions. Even though capital budgeting methods use both hurdle rates and cashflows as inputs, previous survey studies typically do not examine project cashflows in detail and also do not examine whether firms use the correct combinations of discount rates and cashflows. We find that two thirds of our survey firms correctly incorporate inflation into their analysis. Similarly, they appear to successfully determine the domestic/foreign currency denomination of cashflows and discount rates of cross-border investments. Our results also show that the survey firms have a good record in computing levered and unlevered cashflows. However, they do not appear to have as good a record when it comes to matching cashflows and discount rates. Furthermore, half of our survey firms make the mistake of including sunk costs in their cashflow projections. They also do not properly account for the potential erosion in the sales of existing products that could be induced by new product introductions. The survey firms also have somewhat of a mixed record in changing their hurdle rates when market conditions change, and in using divisional versus firm-wide hurdle rates.

Appendices

A.1 Age, Experience, and Education of the Respondents

This section summarizes the characteristics of the responding CFOs. Nearly half of the CFOs (44.6%) are between 40 and 49 years old. Seventy-eight percent fall into the age group 40-59. Experience in the job is evenly distributed across the three categories “less than 5 years”, “5-9 years”, and “10 years or more.” Two-thirds of the CFOs (65.5%) graduated from an MBA program and an additional 12.9% hold a non-MBA masters degree or a higher degree. The degree alone does not necessarily reflect the education of the CFO, as the typical MBA curriculum has changed over the years and the quality of the programs differ. To control for the former effect, we ask the survey respondents for the year they graduated from their last school. On average, twenty years have passed since a CFO completed his last degree (the median year is 1982).

A.2 Beta Coefficient Estimation Procedures

To check the robustness of beta coefficients, we estimate the market model using various procedures. The standard practice is to estimate the market model by running a regression of stock returns against the returns on a market index like the S&P 500. The accuracy of the estimation results depends on a sufficient number of observations. Two obvious ways to increase the number of observations are to use a longer time period or to measure the returns at a higher frequency. The disadvantage of the former approach is that it runs the risk of including historical data that may no longer be representative of the firm’s current and future sensitivity to macro-economic fluctuations. Daily data, on the other hand, tends to be noisy, especially for infrequently traded stocks. For this reason, we estimate the market model using various time period and frequency combinations. We also use some additional specifications including lagged market returns and beta coefficients of comparable firms.

(1) Regressing five years of monthly stock returns on returns of the S&P 500 from January 1999 to December 2003. This is the baseline calculation for most service beta providers (Bloomberg, Ibbotson, Merrill Lynch, Reuters, or Standard & Poor's).[29] We require a minimum of 20 observations, which excludes one firm from our sample.

$$r_{i,t} = \alpha_i^{(1)} + \beta_i^{(1)} r_{S\&P,t} + \varepsilon_{i,t}^{(1)} \tag{1}$$

(2) Estimating the Bloomberg adjusted beta. Bloomberg uses five years of monthly data for the "raw beta", using price appreciation and ignoring dividends. Bloomberg then calculates an "adjusted beta" as

$$\beta_i^{(2)} = 0.66 \times \beta_i^{(1)} + 0.33 \times 1 \tag{2}$$

Instead of raw returns based on price changes, we use returns that are corrected for dividends.

(3) Beta estimation as in (1), with two years of weekly data.

(4) Same as in (1), using two years of daily data.

(5) To reduce the non-trading bias when using daily data we also estimate the characteristic line regression with lagged coefficients, as suggested by Scholes and Williams (1977) and Dimson (1979). We use the concurrent value of the S&P 500 index and four lags, corresponding to one trading week.

$$r_{i,t} = \alpha_i^{(5)} + \sum_{j=0}^{4} \beta_{i,j}^{(5)} r_{S\&P,t-j} + \varepsilon_{i,t}^{(5)} \tag{3}$$

The beta coefficient we obtain from this procedure is the sum of the five estimated beta coefficients in the above equation:

$$\beta_i^{(5)} = \sum_{j=0}^{4} \beta_{i,j}^{(5)} \tag{4}$$

(6) In order to mitigate the problem that for some firms the R-squares from the market model are low, we calculate beta for all firms with the same two-digit SIC code as the survey firms and for which CRSP provides at least 20 monthly returns leading up to December 2003. We then use the equally weighted

[29] Value Line takes the NYSE composite index as the market index. Using the value-weighted or equally-weighted market index of the three major U.S. stock exchanges NYSE, AMEX, and Nasdaq (available at the Center for Research in Security Prices, CRSP) in place of the S&P 500 does not yield substantially different results for our survey firms.

average of these comparable firms, the industry beta, to represent the beta coefficient of the individual firm.

(7) A weighted average of the beta estimates from (1) and (6). We compute the weights based on the R-squares of the two models. This procedure can be written as:

$$\beta_{\mathrm{i}}^{(7)} = \frac{R_i^2}{R_i^2 + R_{industry}^2}\beta_i^{(1)} + \frac{R_{industry}^2}{R_i^2 + R_{industry}^2}\beta_i^{(6)} \qquad (5)$$

(8) For each individual firm we take the maximum of all beta coefficients from models (1) to (7).

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Table I: Summary statistics for self-reported hurdle rates.

The table shows summary statistics of the self-reported hurdle rates. The hurdle rates represent the nominal rate that the company has used for a typical project during the previous two years. Self-reported hurdle rates that represent the cost of levered or unlevered equity are converted to their weighted average cost of capital (WACC) equivalents. This conversion procedure is explained in Section III.C. Out of the 119 respondents to this question, 103 use either WACC, cost of equity or, cost of unlevered equity, and 16 of the responses fall into the category "other" and are dropped. For two out of the 17 firms that use either cost of equity or unlevered cost of equity we cannot match the debt-equity ratio from Compustat to calculate the WACC equivalent. Therefore, we report the hurdle rates for the remaining 101 firms.

Mean	14.1
Median	14.0
Minimum	5.0
Maximum	40.0
Std. dev.	4.9
25th percentile	10.8
75th percentile	15.0
Skewness	1.7
Kurtosis	9.6
N	101

Table II: Summary statistics for beta estimates.

The table contains summary statistics for seven beta estimates from historical market data, and the results when for each individual firm the maximum of all beta estimates is taken. The historical beta coefficients are calculated from regressions of dividend-adjusted stock returns, $r_{i,t}$, on S&P 500 index returns, $r_{S\&P,t}$, using various frequencies, time windows, and shrinkage procedures.

(1) Historical beta using five years of monthly data: $r_{i,t} = \alpha_i^{(1)} + \beta_i^{(1)} r_{S\&P,t} + \varepsilon_{i,t}^{(1)}$.

(2) The beta coefficient $\beta_i^{(1)}$ adjusted towards the overall market value of one: $\beta_i^{(2)} = 0.66 \times \beta_i^{(1)} + 0.33 \times 1$.

(3) Same regression as in (1) using two years of weekly data.

(4) Same regression as in (1) using two years of daily data.

(5) Regression of two years of daily returns on the concurrent and four lags of the S&P 500 index; $r_{i,t} = \alpha_i^{(5)} + \sum_{j=0}^{4} \beta_{i,j}^{(5)} r_{S\&P,t-j} + \varepsilon_{i,t}^{(5)}$. The sum beta then equals $\beta_i^{(5)} = \sum_{j=0}^{4} \beta_{i,j}^{(5)}$.

(6) The industry beta computed as the mean of the beta coefficients from regressions as in (1) for all peer firms within the same two-digit SIC category. The individual regressions are based on five years of monthly data.

(7) A weighted average of the individual firm beta from (1) and the industry beta in (6). The R-squares from the regression in (1) for the individual firm *i*, R_i^2, and the average R-squares across the same regressions for all peer firms within the same two-digit SIC category, $R_{industry}^2$, define the weights: $\beta_i^{(7)} = \frac{R_i^2}{R_i^2 + R_{industry}^2} \beta_i^{(1)} + \frac{R_{industry}^2}{R_i^2 + R_{industry}^2} \beta_i^{(6)}$.

(8) For each firm *i* the maximum of the seven beta coefficients (1) to (7) is taken.

Period	5 years	5 years	2 years	2 years	2 years	5 years	5 years	Various
Frequency	Monthly	Monthly	Weekly	Daily	Daily	Monthly	Monthly	Various
Details		Adjusted towards one			Sum beta	Industry average	(1) and (6) weighted	Maximum of (1) to (7)
Method #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean	0.93	0.94	0.73	0.69	0.94	0.93	1.03	1.33
Median	0.83	0.88	0.62	0.64	0.87	0.83	0.83	1.12
Minimum	-0.27	0.16	-0.32	-0.09	0.00	0.13	0.02	0.37
Maximum	3.12	2.39	2.14	2.16	3.14	1.94	2.76	3.14
Std. dev.	0.72	0.47	0.50	0.47	0.56	0.48	0.56	0.62
25th quantile	0.42	0.61	0.45	0.34	0.63	0.67	0.67	0.87
75th quantile	1.18	1.11	1.01	0.95	1.19	0.92	1.37	1.87
Skewness	1.15	1.15	0.73	0.81	1.03	0.96	0.97	0.90
Kurtosis	4.30	4.30	3.57	3.45	4.96	3.19	3.63	3.35
N	92	92	93	93	93	94	92	94

Table III: Summary statistics for the computed weighted average cost of capital (WACC) and the hurdle rate premium = self-reported hurdle rate – computed WACC.

The table shows summary statistics for the computed weighted average cost of capital (WACC) and the hurdle premium for the sample firms that reveal their identity and where we can match with CRSP and Compustat data. We define the hurdle rate premium as the difference between the self-reported hurdle rate and computed WACC. In calculating cost of equity from the Capital Asset Pricing Model (CAPM) we compare two scenarios for the equity premium (Panels A and B): The historical average excess return of large stocks over long-term bonds from January 1926 to December 2003 of 6.6%, and the median CFO forecast in December 2003 as reported by Graham and Harvey (2005). The risk-free rate in the CAPM is set to 4.3%, the rate for 10-year Treasury bonds at the time of the survey at the end of October 2003. For each equity premium scenario we tabulate statistics for computed WACC and the hurdle rate premium using four different methods to estimate beta coefficients. The specific regressions are detailed in the caption of Table II and explained in Appendix A.2.

Panel A: Equity premium 6.6%.

	Computed WACC				Hurdle rate premium			
Period	5 years	5 years	2 years	5 years	5 years	5 years	2 years	5 years
Frequency	Monthly	Monthly	Daily	Monthly	Monthly	Monthly	Daily	Monthly
Details		Adjusted towards one	Sum beta	Industry beta		Adjusted towards one	Sum beta	Industry beta
Method #	(1)	(2)	(5)	(6)	(1)	(2)	(5)	(6)
Mean	9.30	9.43	9.55	9.50	5.28	5.19	5.12	5.11
Median	8.16	8.51	8.82	9.03	5.23	5.21	4.48	4.95
Minimum	2.68	5.09	4.26	5.13	-6.96	-2.98	-1.96	-5.76
Maximum	21.96	17.98	19.97	17.06	21.07	23.90	26.27	29.88
Std. dev.	4.08	2.82	3.07	2.94	4.88	4.47	4.66	5.61
25th quantile	6.78	7.52	7.69	7.76	2.55	2.11	1.71	2.14
75th quantile	10.82	10.48	11.74	10.20	8.04	7.32	6.76	7.96
Skewness	1.23	1.21	0.85	1.05	0.27	1.09	1.65	1.16
Kurtosis	4.34	4.16	3.74	3.58	4.30	6.24	7.73	6.96
N	83	83	84	85	70	70	71	72

Panel B: Equity premium 3.6%.

	Computed WACC				Hurdle rate premium			
Period	5 years	5 years	2 years	5 years	5 years	5 years	2 years	5 years
Frequency	Monthly	Monthly	Daily	Monthly	Monthly	Monthly	Daily	Monthly
Details		Adjusted towards one	Sum beta	Industry beta		Adjusted towards one	Sum beta	Industry beta
Method #	(1)	(2)	(5)	(6)	(1)	(2)	(5)	(6)
Mean	7.18	7.25	7.31	7.28	7.45	7.40	7.33	7.34
Median	6.57	6.84	6.86	6.97	6.90	6.52	6.72	6.70
Minimum	3.38	4.66	4.20	4.64	0.51	0.65	0.84	-0.57
Maximum	14.21	12.04	12.87	11.87	27.71	29.25	30.54	32.51
Std. dev.	2.32	1.66	1.78	1.69	4.58	4.57	4.65	5.19
25th quantile	5.68	6.12	6.16	6.15	4.20	4.09	4.26	3.95
75th quantile	8.31	8.05	8.50	7.66	9.66	9.18	9.01	9.35
Skewness	1.08	1.12	0.76	0.96	1.43	1.80	2.06	1.81
Kurtosis	3.85	3.82	3.32	3.29	7.11	8.96	10.23	9.22
N	83	83	84	85	70	70	71	72

Table IV: Bivariate regressions of self-reported hurdle rates and the hurdle rate premium on selected financial variables.

We run the regression with the self-reported hurdle rate (columns 2-4) or the hurdle rate premium (columns 5-10) as the dependent variable *y*. We define the hurdle rate premium as the self-reported hurdle rate minus the computed weighted average cost of capital (WACC). The results for the hurdle premium regressions are reported for two scenarios for the equity premium: The equity premium is set to the historical average excess return of large stocks over long-term bonds from January 1926 to December 2003 of 6.6% (columns 5-7) or the CFO consensus forecast in December 2003 of 3.6%, taken from Graham and Harvey (2005) (columns 8-10).

$$y_i = a + b\,(\text{Financial variable})_i + e_i$$

The table shows the set of explanatory variables in the first column, the estimated coefficients *a* and *b* along with the t-statistics in parenthesis below, and the R-squares. The variable systematic risk is defined as $\beta_i \sigma_m$, where β_i is the beta for firm *i* and σ_m the standard deviation of the monthly returns on the S&P 500 over the five years prior to the survey date. Unsystematic risk is defined correspondingly as $\sqrt{\sigma_i^2 - \beta_i^2 \sigma_i^2}$, where σ_i is the standard deviation of firm *i* over the past five years. "Average industry R-squares" is the median R-squares of the market model regressions for all firms within the same two-digit SIC code as the survey firms, using 5 years of monthly data. The observations above/below the mean +/- two standard deviations are dropped for the two ratios market/book assets (2 observations with small book values) and current ratio (4 observations). The variable "past average 5-year industry return" measures the median return over the past five years for all firms in CRSP with the same two-digit SIC code. The binary variables "capital constraints", "managerial constraints", and "adjust for optimistic cash flows" are 1 for firms answering that these are important or very important, and 0 otherwise. Similarly, the binary variable "risk adjustments to hurdle rates" is 1 if firms always or almost always adjust hurdle rates for risk (scores 1 and 2 on a scale from -2 to 2) and 0 otherwise. "Firm recently changed hurdle rate" is 1 if the firm has adjusted the hurdle rate during the past three years, and 0 otherwise. Significantly different from zero at the 1% level ***; at the 5% level **; at the 10% level *.

Financial variable	Self-reported hurdle rate			Hurdle rate premium					
	Equity premium 6.6%			Equity premium 6.6%			Equity premium 3.6%		
	Constant.	Coeff.	R^2	Constant	Coeff.	R^2	Constant	Coeff.	R^2
WACC	9.85	0.52	0.18	9.85	-0.48	0.16	8.70	-0.17	0.01
	(7.08)***	(3.81)***	.	(7.08)***	(-3.56)***	.	(4.73)***	(-0.71)	.
Beta	12.78	2.12	0.09	8.04	-2.94	0.18	8.07	-0.67	0.01
	(13.91)***	(2.64)**	.	(8.95)***	(-3.82)***	.	(8.74)***	(-0.84)	.
Standard deviation	11.38	0.06	0.13	7.33	-0.04	0.05	7.30	0.00	0.00
	(10.18)***	(3.36)***	.	(6.09)***	(-1.94)*	.	(6.30)***	(0.14)	.
Systematic risk	12.76	0.12	0.09	8.03	-0.17	0.17	8.05	-0.04	0.01
	(13.89)***	(2.67)***	.	(8.92)***	(-3.79)***	.	(8.71)***	(-0.81)	.
Unsystematic risk	11.67	0.06	0.12	6.79	-0.03	0.03	7.08	0.01	0.00
	(10.51)***	(3.16)***	.	(5.72)***	(-1.46)	.	(6.27)***	(0.38)	.

Average industry	16.45	-23.30	0.04	8.98	-49.31	0.16	10.40	-39.37	0.12
R-squares	(14.00)***	(-1.68)*	.	(7.85)***	(-3.66)***	.	(9.46)***	(-3.04)***	.
Market/book assets	13.47	0.54	0.02	3.76	1.04	0.06	5.39	1.32	0.10
	(14.96)***	(1.32)	.	(3.74)***	(2.03)**	.	(5.69)***	(2.72)***	.
Average 5-year industry	11.15	2.21	0.08	2.19	1.95	0.06	3.75	2.33	0.10
return	(7.42)***	(2.54)**	.	(1.40)	(2.13)**	.	(2.62)**	(2.77)***	.
Cash/assets	12.47	20.48	0.21	4.20	10.99	0.07	5.90	15.70	0.15
	(19.41)***	(4.53)***	.	(5.59)***	(2.19)**	.	(8.80)***	(3.51)***	.
Debt/assets	15.47	-4.95	0.06	6.01	-3.41	0.03	8.75	-6.08	0.10
	(21.06)***	(-2.21)**	.	(7.61)***	(-1.37)	.	(12.27)***	(-2.69)***	.
Current ratio	12.12	0.73	0.07	3.96	0.34	0.01	5.24	0.71	0.07
	(15.36)***	(2.31)**	.	(3.90)***	(0.85)	.	(6.39)***	(2.19)**	.
Z-score	10.85	1.44	0.03	-1.67	2.82	0.09	0.29	2.92	0.11
	(4.29)***	(1.43)	.	(-0.61)	(2.62)**	.	(0.11)	(2.92)***	.
Ln(assets)	14.56	-0.03	0.00	5.55	-0.04	0.00	8.02	-0.09	0.00
	(8.53)***	(-0.13)	.	(2.94)***	(-0.15)	.	(4.55)***	(-0.34)	.
Ln(sales)	16.02	-0.27	0.02	6.48	-0.20	0.01	9.64	-0.37	0.03
	(11.84)***	(-1.25)	.	(3.74)***	(-0.73)	.	(6.00)***	(-1.45)	.
Capital constraints	14.15	-0.02	0.00	5.30	-0.04	0.00	7.51	0.13	0.00
	(28.47)***	(-0.06)	.	(8.76)***	(-0.10)	.	(13.28)***	(0.32)	.
Managerial constraints	14.13	0.04	0.00	5.25	0.19	0.00	7.39	0.29	0.01
	(26.66)***	(0.08)	.	(8.51)***	(0.39)	.	(12.83)***	(0.61)	.
Risk adjustments to	13.05	1.33	0.05	4.23	1.37	0.06	6.23	1.48	0.07
hurdle rates	(16.14)***	(2.12)**	.	(4.38)***	(1.91)*	.	(6.74)***	(2.17)**	.
Adjust for optimistic	14.46	-0.63	0.00	5.14	0.41	0.00	7.60	-0.30	0.00
cash flows	(22.81)***	(-0.61)	.	(6.69)***	(0.33)	.	(10.56)***	(-0.26)	.
Firm recently changed	14.97	-1.61	0.03	5.33	-0.04	0.00	7.50	-0.08	0.00
hurdle rate	(20.67)***	(-1.62)	.	(6.07)***	(-0.04)	.	(9.00)***	(-0.07)	.

Table V: Explaining the hurdle rate premium.

The table shows the results for regressions of the hurdle premium on various financial variables. The estimated coefficients and the corresponding t-statistics in parenthesis are tabulated for two scenarios for the equity premium: The historical average excess return of the S&P index over the 10-year T-bond rate of 6.6% (from January 1926 to December 2003) and the CFO consensus forecast in December 2003 of 3.6%, taken from Graham and Harvey (2005). For each equity premium scenario the hurdle premium is first regressed on all significant variables (at the 5% level) in the bivariate regressions from the previous Table IV. Out of the three risk variables essentially measuring systematic risk (WACC, beta, and systematic risk) only systematic risk is retained. In the adjacent Models (2) and (4) are the coefficients for those variables that remain after using stepwise regression. The significance level for removal from the model is set to 0.20.

	Equity premium 6.6%				Equity premium 3.6%			
Model #	(1)		(2)		(3)		(4)	
	Coeff.	t-statistic	Coeff.	t-statistic	Coeff.	t-statistic	Coeff.	t-statistic
Systematic risk	-0.15	(-3.40)***	-0.16	(-3.92)***	.	.	.	.
Market/book assets	0.48	(1.12)	.	.	0.36	(0.71)	0.68	(1.64)
Cash/assets	10.23	(2.36)**	10.73	(2.50)**	6.76	(1.32)	10.14	(2.60)**
Debt/assets	.	.	.	.	-0.07	(-0.03)	.	.
Average 5-year industry return	1.53	(2.05)**	1.73	(2.33)**	1.87	(2.37)**	1.81	(2.52)**
Z-score	0.41	(2.52)**	0.40	(2.73)***	0.38	(1.88)*	0.51	(3.41)***
Current ratio	.	.	.	.	-0.10	(-0.23)	.	.
Risk adjustments to hurdle rates	.	.	.	.	0.24	(0.42)	.	.
Average industry R-squares	-30.54	(-2.58)**	-35.14	(-3.03)***	-34.71	(-2.99)***	-32.69	(-2.97)***
Constant	4.31	(2.51)**	5.25	(3.25)***	4.10	(1.75)*	3.13	(1.95)*
N	68		69		56		68	
Adjusted R-squares	0.41		0.44		0.21		0.42	

Table VI: Calculation of cashflows.

Summary of the answers to the question how firms calculate cash flows when evaluation projects. The questionnaire provided five alternatives to choose from, a) to e), and allowed for an open end answer under "other." Tabulated are the absolute number and the fraction of firms employing a given method. A total of 123 CFOs answered this question.

In evaluating projects the cash flows you use are calculated as	# of firms	Fraction
a) earnings before interest and after taxes (EBIAT) + depreciation.	20	16.3%
b) earnings before interest and after taxes (EBIAT) + depreciation – capital expenditures – net change in working capital.	56	45.5%
c) earnings.	7	5.7%
d) earnings + depreciation.	6	4.9%
e) earnings + depreciation – capital expenditures – net change in working capital.	31	25.2%
f) Other.	3	2.4%

Table VII: Cannibalization and sunk cost.

The table shows the number of firms and the corresponding percentage answering to two survey questions regarding cannibalization (112 respondents) and sunk costs (total of 124 respondents).

1. 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?	# of firms	Fraction
a) Yes.	91	81.3%
b) Yes, but only if competitors are likely to introduce a product similar to the new product.	3	2.7%
c) Yes, but only if the competitors are unlikely to introduce a similar product.	2	1.8%
d) No.	16	14.3%
2. In valuing projects, do you incorporate into the cash flows the money you spent before the period when you make the accept/reject decision?		
a) Yes.	65	52.4%
b) No	59	47.6%

Table VIII: Consistency between hurdle rates and cashflow calculations.

The rows in the cross-tabulation indicate what the self-reported hurdle rate represents and the columns denote five different ways to calculate cash flows, a) to e), plus the "other" category. Each cell displays the percentage of all 113 respondents for a given combination.

The definitions of the cash flow calculations are:
a) Earnings before interest and after taxes (EBIAT) + depreciation
b) Earnings before interest and after taxes (EBIAT) + depreciation – capital expenditures – net change in working capital
c) Earnings
d) Earnings + depreciation
e) Earnings + depreciation – capital expenditures – net change in working capital

Hurdle rate	Cash flow calculation						Total
	a)	b)	c)	d)	e)	Other	
WACC	11.3	34.8	2.6	3.5	19.1	0.0	71.3
Equity levered	0.9	2.6	0.9	0.0	0.9	0.9	6.1
Equity unlevered	1.7	1.7	0.9	0.9	1.7	0.9	7.8
Other	2.6	5.2	1.7	0.9	3.5	0.9	14.8
Total	16.5	44.4	6.1	5.2	25.2	2.6	100.0

Table IX: Consistency of nominal and real terms in hurdle rates and cashflows.

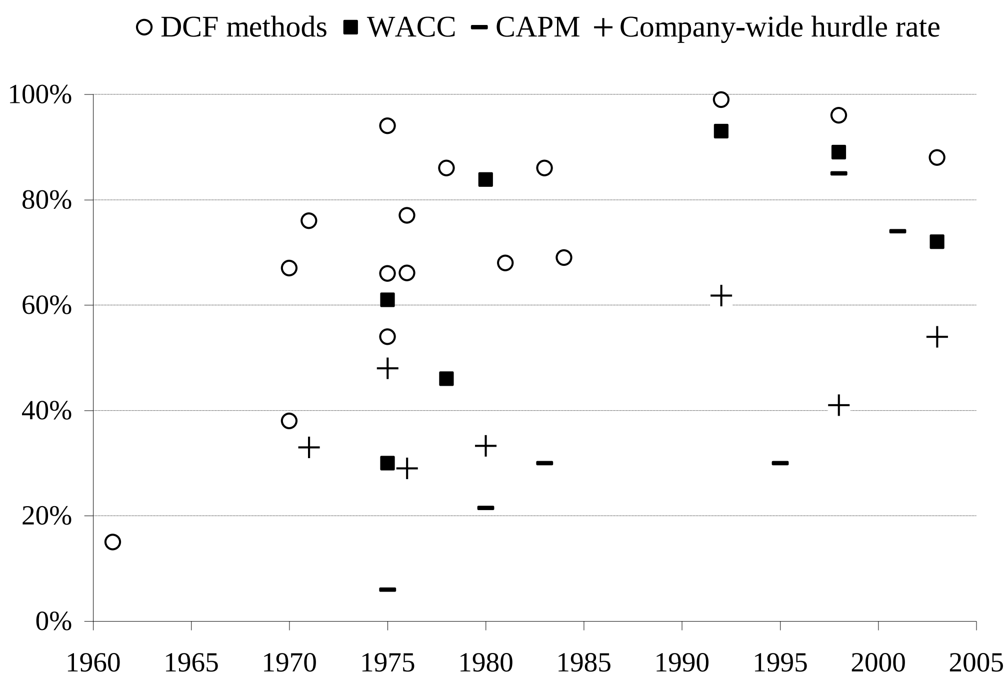
The rows in the cross-tabulation show whether the firm uses a nominal or real hurdle rates, and the columns indicate whether cash flows are calculated in nominal or real terms. The cells contain the percentage of firms, out of a total of 121 respondents to the two separate survey questions.

Hurdle rate	Cash flows		Total
	Nominal	Real	
Nominal	29.8	19.8	49.6
Real	11.6	38.4	50.4
Total	41.3	58.7	100.0

Figure 1: Adoption of DCF methods, WACC, CAPM, and company-wide hurdle rates over time.

The figure provides an overview of the survey literature on capital budgeting practices of U.S. firms. The studies are listed in chronological order below the horizontal time axis. The graph summarizes their findings regarding the percentage of firms that

a) 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);
b) use the weighted average cost of capital (WACC) to discount cash flows,
c) employ the Capital Asset Pricing Model (CAPM) to compute cost of equity, and
d) use a company-wide hurdle rate.



Istvan (1961)
Mao (1970)
Klammer (1972)
Fremgen (1973)
Brigham (1975)
Petry (1975)
Petty et al. (1975)
Gitman and Forrester (1977)
Schall et al. (1978)
Gitman and Mercurio (1982)
Moore and Reichert (1983)
Klammer and Walker (1984)
Bierman (1993)
Trahan and Gitman (1995)
Poterba and Summers (1995)
Bruner et al. (1998)
Graham and Harvey (2001)
Meier and Tarhan (2007)

Figure 2: Company characteristics.

The two panels summarize the self-reported industry affiliation and sales figures and show the percentage of firms within each category.

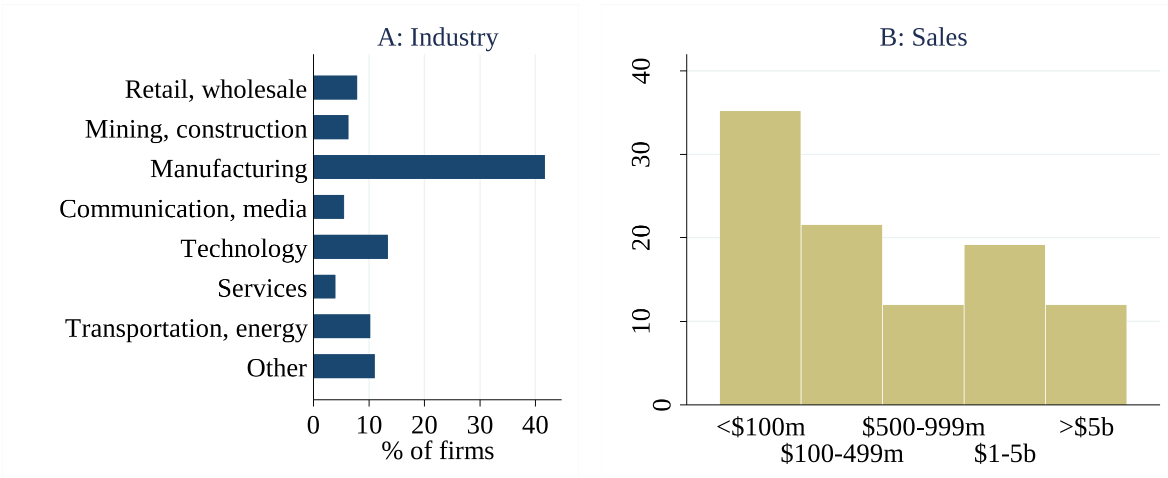


Figure 3: What the self-reported hurdle rate represents.

A total of 117 firms responded to the question what the firm's hurdle rate represents. The eleven firms that explicitly indicate that they add a premium to the weighted average cost of capital (WACC) to assess their hurdle rate are included in the category WACC.

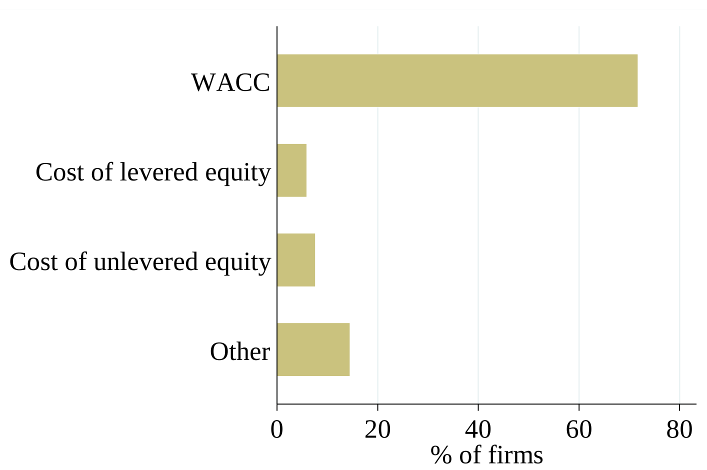


Figure 4: Hurdle premium using two scenarios for the equity premium.

We define the hurdle premium as the difference between the self-reported hurdle rate and the weighted average cost of capital (WACC) that we compute from CRSP and Compustat. We use the Capital Asset Pricing Model (CAPM) to infer the cost of equity with 4.3% as the risk-free rate (10-year Treasury bond rate in October 2003) and two scenarios for the equity premium (Panels A and B): A historical equity premium of 6.6% (return on large stocks minus the return on long-term government bonds from 1926-2003), and the median CFO forecast for the premium of the S&P 500 index over the 10-year Treasury bond yield in December 2003, reported by Graham and Harvey (2005). Beta coefficients are inferred from a market model regression of the firm's monthly returns on returns on the S&P 500 over the past five years.