Corporate Investment Decision Practices And the Hurdle Rate Premium Puzzle

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Abstract

We survey a cross-section of 127 companies to shed light on various dimensions of the investment decisions. The questions posed by our survey examine the hurdle rates firms use, calculations of project related cashflows, the interaction of cashflows and hurdle rates, and the determinants of firms' capital structure policies. Unlike previous studies which examine investment decisions by either using survey data or data obtained from financial tapes, we use both sets of data. This approach produced one of our primary findings that there is a hurdle rate premium puzzle, in that hurdle rates used by our sample of firms exceed their cost of capital that we calculate using Compustat data by 5%. We investigate the determinants of the hurdle premium in question. Additionally, we find that both systematic and to a lesser extent unsystematic risk play a role in determining the hurdle rates. Furthermore, our findings show that while firms use discounted cashflow methods in evaluating projects, they do not always appear to handle the cashflow dimension of their investment decisions in a consistent manner. Finally, we uncover evidence that firms use the various financing alternatives available to them in the order predicted by the pecking-order hypothesis. However, some of the variables affiliated with the trade-off model also appear to play a role in the capital structure decision.

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1. Introduction

This paper discusses the findings we obtained from a survey that covered a comprehensive list of investment and financing related issues firms face in making their investment decisions. The survey was completed by the CFOs of 127 companies in October 2003. A subset of the topics we address have been examined by earlier studies either in the context of empirical tests that use data from financial databases or by using data obtained from surveys. Using data obtained from one of these two alternative sources, studies investigate to what extent the predictions of models of corporate investment and financing behavior is supported by the data that they choose to use. Since both of these testing methodologies have strengths and weaknesses, in this study, we conduct tests using both survey data and data obtained from financial tapes. Additionally, using both types of data enables us to compare how they behave with how they should behave based on theory.

Tests that rely on empirical models typically are conducted using data available in financial data bases such as CRSP and Compustat. The advantage of such data is that they contain substantial number of observations which increases the level of confidence regarding the accuracy of results. Additionally, the data in question is determined objectively. However, this objectivity could come at a cost. Financial models of investment decisions posit how managers/investors *should* behave based on model specifications. Thus, ideally, the predictions contained in these models need to be tested with data that captures the *actual behavior* of the managers. However, the data obtained from financial tapes do not fully reflect how managers behave since the data in question represents the realizations of financial variables. These realizations are determined not only by the behavior of managers, but by the intersection of the behavior of decision makers and the exogenous environment. For example, the realized sales of a firm does not just reflect how managers behaved in making their investment decisions (in the past), but it also reflects factors such as the current state of the economy, investments of competitors, etc. Thus, while the models specify how managers *should* make their investment decisions, the predictions of the models is tested with data that is produced only *partially* by managers' behavior, since the data also reflects the behavior of consumers, competitors, as well as the general economic environment. Additionally, while the data may tell us *ex-post*, whether a particular investment decision was a

success or a failure, the data in question does not provide information about whether managers *ex-ante* followed the correct procedures in making their decisions. In other words, it is not possible to ascertain with certainty whether a particular project succeeded/failed due to the managers' correct/incorrect approach, or, because of factors that are not in their control, such as the changes in the external environment, the types of investments their competitors made, etc.

The strength of the survey data based testing methodology is that, if the survey questions are designed carefully, the *behavior* of agents predicted by the theory can be captured directly. On the other hand, this test methodology also has some weaknesses. First, typically surveys do not produce anywhere as much data points as the data available in financial data bases. Second, if survey questions are not phrased correctly, the results based on the answers would not be meaningful. Finally, survey data, by its nature is subjective. However, the subjectivity of the data is not always problematic, provided the survey is well designed, since financial models predict how agents *should* behave and the tests of these predictions need to be conducted with data that shows how they actually *do* behave. Answers obtained from well-designed survey questions constitute data that shows how managers indeed do behave.

From the methodological standpoint, one of the important contributions of this study is that we use both survey based data and data obtained from financial tapes to test how managers make their investment and financing decisions. We are able to do this since we know the identities of our survey participants, and thus are able to supplement our survey data with CRSP and Compustat data. The combined approach we follow has several advantages. First, we can test the robustness of the results by using both types of data. Second, the comparison of results obtained from both sources of data could be very revealing. In fact, it is actually on the basis of such a comparison that we are able to document one of the important findings of this study: there appears to be a hurdle rate premium puzzle. We find that hurdle rates on average exceed computed WACC by 5%. Furthermore, the tests we conducted showed this figure to be very robust. Since the hurdle rate premium is the difference between what the hurdle rate used by managers in reality *is* (obtained from survey data) and what it *should be* (obtained from computing cost of capital by using publicly available data), the presence of the puzzle in question can best be documented by using both sources of data. We conduct empirical tests on hurdle

rates, computed WACC, and hurdle premiums in order to uncover the determinants of these variables and also to explain the hurdle rate premium puzzle.

Previous surveys on how firms make their investment decisions, such as Poterba and Summers (1995), Graham and Harvey (2001), Bierman (1993), Trahan and Gitman (1995), and Bruner et al. (1998), primarily focus on documenting the popularity of the different capital budgeting techniques used by firms, and the size of the hurdle rates firms use in evaluating their investment projects. After documenting the stylized facts surrounding the investment decisions of firms, authors analyze their survey results to determine how various firm and market variables play significant roles in shaping the firms' investment decisions. 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 (e.g., 88.1% of the firms in our survey report using DCF techniques). Second, most firms apparently use their weighted average cost of capital (WACC) as the discount rate in evaluating their projects. Third, it also 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 3 displays the increased usage of these models and techniques.

While our survey respondents, by-and-large confirm these findings, we supplement the traditional investment decision issues addressed by past surveys by examining additional topics that are important to the investment and financing decisions of firms. For example, we examine whether or not firms are consistent in matching project cashflows with appropriate discount rates (i.e., we examine what discount rates are used when cashflows are levered versus when they are unlevered). Our survey also contains questions to determine whether or not firms are consistent in accounting for inflation in the cashflows and the hurdle rate components of their projects. Additionally, we probe survey participants about some cashflow specific topics such as how they account for sunk costs, and, cannibalization of the sales of their existing products when making decisions about the introduction of new products. Another issue we examine is whether firms correctly analyze their cross-border projects by using consistent foreign currency/domestic currency denominated cashflow/hurdle rate combinations. Finally, we conduct various empirical

tests to examine the determinants of self-reported hurdle rates, computed WACC, and the hurdle premium.

In addition to the investment decision, we also address how firms formulate their capital structure policy. In particular, we attempt to uncover whether their capital structures can be explained by the trade-off model related variables. We also consider to what extent their behavior can be explained by the pecking-order hypothesis. Towards this end, we ask them to rank the order in which they use the financing alternatives available to them. Various studies attempt to test the pecking-order hypothesis by estimating regression models (e.g., Frank and Goyal (2003), Shyam-Sunder and Myers (1999), and Myers (2001)). However, the pecking-order hypothesis has some strong predictions regarding the order in which firms use various internal and external financing alternatives that they have at their disposal. It can be argued that it would be difficult to determine the order in which firms use financing alternatives available to them by conducting regressions based empirical tests of this model. However, this issue can be easily addressed by survey questions. For this reason, we believe that survey based methodology, rather than regression based empirical tests, is most suited for a direct test of the predictions of this hypothesis.

Our important findings are as follows: Our survey results show that in general firms are using the correct (DCF) capital budgeting methods in evaluating projects. However, they display somewhat of a mixed record on the cashflow component of their investment decisions. While in general they calculate both levered and unlevered cashflows correctly, they do not always use the correct cashflow-hurdle rate combinations. Moreover, not al firms appear to correctly account for some cashflow related issues, such as sunk costs and erosion in sales of existing products. However, the survey responses also indicate that they correctly incorporate inflation into their analysis. Additionally, on the complicated topic of cross-border investments, they appear to use correct combinations of foreign currency/domestic currency denominated cashflows and discount rates.

The survey responses also show that, by a wide margin, hurdle rates they use reflect what they believe their WACC to be. Furthermore, our findings which show that their hurdle rate is related

to their systematic risk and also to their actual WACC (that we compute), implies that they use CAPM and the theory of cost of capital. While we conduct various tests that confirm their use of CAPM, unsystematic risk also appears to play some (lesser) role in the determination of their discount rates. However, the results also show that some firms appear not to adjust their hurdle rates with sufficient frequency, and that some firms use firm-wide hurdle rates even when they have multiple divisions. Needless to say, both of these hurdle rate missteps have the potential to create underinvestment/overinvestment problems.

We believe that the paper also makes important contributions on the topic of the capital structure decision. In particular, we find very strong support for the predictions of the pecking-order theory regarding the order in which firms use various internal and external financing sources. While our results support the major prediction of the pecking-order model, at the same time, firms' behavior regarding the capital structure decision closely matches some of the important predictions of the trade-off theory. The evidence we uncover in favor of both capital structure theories is not contradictory since these two major theories of capital structure are not mutually excusive. Our findings that elements of *both* of the two competing capital structure theories are supported confirm the findings of Fama and French (2005). They reach the same conclusion by examining the attributes of 12 portfolios that they form on the basis of risk, profitability, and growth characteristics of firms.

The plan for the remainder of the paper is as follows: First, we discuss survey design and sample characteristics in section 2. A brief discussion of capital budgeting methods used by our survey participants is presented in section 3. In section 4, we present and discuss our findings on issues about the cashflow component of investment decisions. We follow the discussion of cashflow related issues with our findings regarding the hurdle rates firms use in section 5. On this topic, we examine the summary statistics on hurdle rates, what represents the hurdle rates that firms use, whether or not firms adjust their hurdle rates over time as market conditions change, and to what extent multi-segment firms use company-wide versus divisional hurdle rates. In section 6, we discuss issues relating to the interaction of cashflows and hurdle rates, and whether or not firms are consistent in matching project cashflows with the appropriate hurdle rates. Section 7 presents our calculations of WACC for our survey firms, and also discusses the summary

statistics on our computed WACC. Section 8 documents the hurdle rate premium puzzle. To gain insight about this puzzle we run two sets of bivariate regressions on the hurdle rate, and also on the computed WACC using the same explanatory variables. In the same section, we also conduct empirical tests directly on the hurdle premium. We address how firms make their capital structure decisions in section 9. Finally, we present our conclusions in section 10.

2. Survey Design and Sample Characteristics

2.1 Questionnaire

When designing the survey we carefully followed the advice from experts in the fields of psychology and marketing. We designed the questions in such a way that we avoided buzz words and names of models that are taught in a typical MBA course. For example, as we conjecture that there might be a wedge between cost of capital and the discount rate, we avoid the term cost of capital in our questionnaire. Instead, we ask for the rate that the firm uses to discount cash flows. Similarly, we did not use terminology such as levered and unlevered cashflows, but rather provided them with the definitions of the two types of cashflows for them to choose from. 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 sender of the survey by providing the answers they think the sender expects. Therefore, we did not want to prompt them by asking what models they use, but simply what number they use to discount a the cash flows of a typical project.

The input from numerous academics in the field helped to further improve the content of the questions. 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 is not ambiguous. The survey was sent out together with a cover letter from the Dean Emeritus of the Kellogg School of Management, Donald Jacobs, on September 12, 2005, 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.

Most respondents revealed their identity. Almost all surveys were filled out completely. 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 provided elaborate comments for open questions.

2.1 Sample Description

Figure 1 describes the characteristics of the 127 firms in our sample.[2] Panel A shows the breakdown by industry. Similar to previous surveys (e.g. in Graham and Harvey's (2001) survey the manufacturing sector represents 40%, in Poterba and Summers (1995) the ratio is 60.6%) manufacturers dominate (41.7%), followed by technology sector firms (13.4%), and transportation and energy (10.2%).[3] . In a number of surveys the fraction of manufacturing firms is even more pronounced than our survey [e.g. 93.8% of the respondents in Gitman and Mercurio (1982) with 74% in Gitman and Forrester (1977)]. Banks and insurance companies were excluded from the mailing list.

Firm size measured by sales (based on the self-reported numbers of the survey) is below $100 million for 35.2% of the companies (see Panel B). 31.2% of the responding firms report sales in excess of $1 billion. The majority of the firms (72.0%) have multiple product lines. Fourteen respondents (11.3%) are privately owned firms. Appendix A reports details on other firm characteristics and the profiles of the responding CFOs.

3. Capital Budgeting Methods

We asked the survey participants to select their first and second choices for the capital budgeting methods they use. Figure 2 summarizes their responses. The options represent some Discounted

[2] We exclude financial firms that 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 health, educational, 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).

[3] The category "Transportation, Energy" replaces the category "Utility" that was included in the survey. These respondents indicated under "Other" that they are in the transportation (5 respondents) or energy business (7).

Cashflow (DCF) methods (NPV, IRR, Profitability index, and APV), as well as methods that violate basic premises of Finance (such as payback, and Average Rate of Return). The survey results indicate that 88% of the respondents rank the DCF methods of NPV or IRR as either their first or second choice. IRR (53 firms) was slightly ahead of NPV (46 firms) as the first choice of the participants. The use of the correct capital budgeting methods by our survey firms is not surprising since surveys conducted earlier show that DCF methods have become increasingly popular with the passage of time. In fact, Figure 3 plots this trend. The figure shows that different surveys conducted over time indicate that DCF capital budgeting methods increased from less than 20% around 1960 to almost 100% for large firms in 2000 (the same figure also shows similar increases in the use of CAPM and WACC by firms over time).

Next, we examine whether the degree of sophistication of the capital budgeting method is linked to the size of the firm. We pool the methods NPV, IRR, and adjusted Present value or APV (3 firms) into a single category (DCF techniques), and the other methods into a second group. Table 1 tabulates the fraction of firms that use NPV techniques as their primary capital budgeting method by different firm size groups. About two thirds (27 out 43, or 62.8%) of the smallest firms (defined as firms with maximum sales of $100 million) in our sample, use DCF techniques. For firms with sales below $500 million, the DCF usage percentage increases to 70% (49 out of 70 firms). In the case of companies that report sales above the $1 billion threshold, the fraction jumps to 91.9% (34 out of 37 firms). Finally all of the 13 respondents with sales in excess of $5 billion use DCF methods. These results show that while even smaller firms by a substantial margin rely more on DCF methods than non-DCF methods, use of DCF methods increases as firm size increases.[4]

When we divide the survey sample into manufacturing versus non-manufacturing firms, we find that the manufacturing firms in our sample employ DCF methods as their primary capital budgeting to a lesser extent than non-manufacturing firms (67% vs. 84%) **(is this size related? i.e., are manufacturing firms smaller than non-manufacturing firms?)**. We do not find any difference in DCF usage on the basis of firm leverage being high or low. Apparently, it is also

[4] We get similar results when using the market value of assets computed from Compustat data instead of the self-reported sales numbers.

the case that neither the age nor the tenure of CFOs is related to their firms' use of DCF methods. However, firms with volatile earnings (defined as firms with standard deviation of (EBITDA/Book value of assets during the previous 10 years that exceeds 10%) are less likely to use DCF techniques (61.9% vs. 86.9%).

In sum, our results about different capital budgeting methods confirm the prevailing trend that use of DCF based models continue to increase with survey dates. While our survey provides some evidence that larger firms rely on DCF methods more than smaller firms, and that non-manufacturing firms appear to rely on DCF methods more than manufacturing firms, the overall conclusion is that in today's world a substantial proportion of firms rely on DCF methods in making their investment decisions.

4. Cashflow Related Issues in investment Decisions

In section 3 we addressed the issue of capital budgeting methods used by survey firms. All DCF techniques use two inputs: cashflows and discount rates. It is possible that even a firm is using correct capital budgeting methods in evaluating its projects it could still make the incorrect decision of accepting bad projects or rejecting good projects if it is not matching the two components correctly. Thus, in our survey we asked questions about project cashflows, hurdle rates, and their interactions. We first discuss our survey results on cashflows. Later on we then turn our attention to the examination of hurdle rates, and issues relating to what cashflows are matched with what type of hurdle rates.

4.1 Calculation of Cashflows, Sunk Costs, and Cannibalization of Existing Product Sales

Table 2 shows that 44.4% 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) when evaluating projects. Levered cashflows (Net income + depreciation-capital expenditures- change in net working capital) appear to be the next popular cashflow computation (24% of the firms use it). About 16% of the firms use the "unlevered cashflow" definition where expenditures on fixed and current assets are not subtracted. Thus, in sum, about

68% of the firms employ correct definitions of either levered or unlevered cashflows while the remaining 32% of the survey firms use cashflows that are defined incorrectly. Obviously, firms could use either levered or unlevered cashflows, provided that the cashflows used are matched with the correct discount rate. We will examine below to what extent firms successfully form cashflow/discount rate combinations.

Table 3 displays how the survey firms deal with sunk costs and the loss of sales in existing products when new products are introduced. We addressed the sunk costs issue with the following question: "In valuing projects, do you incorporate into the cashflows the money you spent before the period you make your accept/reject/decision?" Surprisingly, 65 out of the 124 survey respondents (52.4%), answered this question affirmatively (47.6% of the respondents gave a "no" answer).

To the question of whether or not they subtract expected loses in the sales of existing products when they are evaluating introducing new products, 81.3% of the respondents unequivocally said "yes", while only 2 firms (1.8%) qualified their answer by checking the option that they would do so only if their competitors are unlikely to introduce products similar to the new product they are considering. 16 firms (14.3%) indicated that they would not adjust projected sales of new products for the erosion they will cause in existing products. Given the highly competitive nature of U.S. industries, it is surprising that 84% of the firms indicated that they would forecasts sales for new products as if there are economic barriers to entry.

5. Self-reported Hurdle Rates

In this section, we first discuss the summary statistics on self-reported hurdle rates (section 5.1). In section 5.2, we examine what the survey participants claimed the hurdle rate figures they provide in the survey represent (i.e., is it their WACC, cost of levered equity, etc.). As discussed below, a substantial number of firms use their WACC as their hurdle rate. However, some firms use their levered or unlevered cost of equity as their hurdle rates. In section 5.3, we convert cost of equity based hurdle rates to their WACC equivalents in order to create a uniform (WACC based) data of hurdle rates. We then, combine this data with the self-reported WACC based

hurdle rate data. Thus, after the conversion procedure all hurdle rates reflect survey participants' perception of their WACC. In section 5.4 we explore to what extent they change their hurdle rates over time, and also whether multi-divisional firms use firm-wide or divisional hurdle rates.

5.1 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. We also asked them if they use multiple hurdle rates what their lowest and highest rates were. For firms that reported their minimum and maximum hurdle rates, we took the mid-point of the two. Table 4 displays the summary statistics of the answers of 101 firms to the hurdle rate question. Figure 5 shows the distributions of the hurdle rates. The results in Table 4 show that the mean hurdle rate in our sample is 14.1% in nominal terms (median 14%).[5] None of the numbers is less than 5% and the maximum is 40%. Furthermore, the skewness coefficient of 1.7 confirms that the distribution is fairly symmetric, and the kurtosis coefficient of 9.4 confirms that the distribution is centered around the mean and the median. Adjusting for the average inflation during the past two years of 2.2% (January 2000 to December 2003),[6] produces an average real hurdle rate of 12.3% which is almost identical to the 12.2% real hurdle rate reported in the survey conducted by Poterba and Summers (1994).

The hurdle rates obtained from both Poterba and Summers and our survey appear to be high. While earlier surveys such as such as Gitman and Forrester (1997), and Gitman Mercurio (1982) also report high rates (14.1%, and 14.3%, respectively), the nominal rates that they report are not necessarily high in real terms, considering that during the time of the latter two surveys the yield on long-term government bonds were in the 12 to 14 percent range. Poterba and Summers surmise that these rates appear to be higher than even cost of equity. In this study, because we know the identity of firms in our survey, we are actually able to document numerically how high the hurdle rates are compared to WACC and also their levered cost of equity. The comparison of the WACC based self-reported hurdle rates of survey participants with their computed WACC

[5] If a range is provided instead of a single number then we take the average (6 respondents). For 5 firms we infer the typical hurdle rate as the average of the lowest and highest rate. One observation is reported in real terms and we add the average inflation from 2000-2003 of 2.5%.
[6] Inflation rates are based on the Consumer Price Index (CPI-U) compiled by the Bureau of Labor Statistics.

(that we describe below) reveals that the hurdle rates used by the survey firms exceed their computed WACC, by a significant 5%. In section 8, we conduct empirical tests to examine the determinants of this hurdle rate premium puzzle.

5.2 What Do Hurdle Rates Represent?

Of the 117 firms that responded to the question on what their hurdle rate represents, the vast majority of CFOs (71.8%) claimed that the hurdle rate they use was their weighted average cost of capital (WACC). Apparently, in the case of 7 firms (6.0%), the hurdle rate was the cost of their levered equity, while for 9 firms (7.7%) it represented their unlevered cost of equity. For 17 firms (14.5%), the hurdle rate fell into the "other" category. The bar chart in Figure 4 illustrates these fractions. The widespread use of WACC is consistent with the findings of Bruner, Eades, Harris, and Higgins (1998), and Bierman (1993) who documents an even larger fraction of firms using WACC. Thus, it seems to be the case that similar to the increased use of DCF based capital budgeting techniques and CAPM, the use of WACC has also increased over time. This positive trend in the use of CAPM and WACC over time is shown in Figure 3**.** For example in a survey conducted 30 years ago, Petty, Scott, and Bird (1975) document that only 30% of the firms in Fortune 500 that responded to their survey, used WACC. Similarly, a survey by Schall, Sundem and Geijsbeek (1978) finds that 46% of the firms use WACC.

5.3 Conversion of Non-WACC Self-reported Hurdle Rates to WACC Based Self-reported Hurdle Rates

In the cases where survey participants indicated that they use either levered or unlevered cost of equity as their hurdle rate, we transformed this data in a manner such that their hurdle rate was expressed in WACC terms. If they indicated that they use cost of levered equity as their hurdle rate we simply plugged in this rate for the cost of equity component of WACC and averaged it with their after-tax cost of debt using market value based weights to express their hurdle rate in WACC equivalent terms. If they indicated that their hurdle rate represents their cost of unlevered equity, we checked if they had any long-term debt. For firms that did not have any

debt, their unlevered cost of equity was obviously the same as their WACC. In cases where firms had debt in their balance sheet, we levered up their cost of unlevered equity to obtain their cost of levered equity, and then imputed their WACC-based hurdle rate by averaging their cost of levered equity and their after-tax cost of debt by using the appropriate weights. These procedures enabled us to obtain WACC based hurdle rates for 101 firms.

5.4 Hurdle Rate Adjustments and Potential Under/Over Investment Problems

Firms could under or over invest if they do not adjust their hurdle rates as market conditions change. In an environment where cost of debt and equity are declining, if firms do not lower their hurdle rates accordingly, they would run the risk of underinvesting. Similarly, when facing market conditions where cost of capital is increasing, firms that do not adjust their hurdle rates upwards, would suffer from overinvesting. Investment decision biases in the form of under- or overinvestment can also be created if firms with multiple segments use company-wide cost of capital for all their projects rather than discounting projects from different divisions at the divisional cost of capital. It is a well known fact that both underinvestment and overinvestment problems would result in destruction of shareholder value and also cause capital allocation distortions in the economy.

When firms have an overinvestment bias, the problem would be more visible since the acceptance of negative NPV projects would cause stocks of these firms to under perform. When the bias is in the direction of underinvestment, on the other hand, while there will still be destruction of shareholder value, the destruction in question would not be as transparent since rejection of positive NPV projects, on paper, would not cause a decline in a firm's stock price. However, this type of error will be equally damaging to the shareholders since the presence of underinvestment problem would prevent the stock price of the guilty firm from appreciating. Thus, whether the loss is in the form of actual decline of stock prices, or blockage of potential stock price increases, shareholders will suffer as a result of both errors. To determine the extent of these problems we asked our survey participants how often they changed their hurdle rates in the recent past (during the three years preceding the survey). We also asked multi-divisional firms whether they used firm-wide or divisional hurdle rates in evaluating their projects.

In addition, survey participants were asked how they would handle strategic projects. The answers indicated that that 70.7% of the respondents consider strategic projects to be more valuable than non-strategic projects. 29.3% of the participants indicated that they would use a lower hurdle rate to account for the incremental value generated by strategic projects, while 41.4% of the firms answered that they would capture the additional benefits in question by valuing the future projects made possible by the project in question separately and add this amount to the value of the stand-alone value of strategic projects. 29.3% of the respondents, on the other hand, argued that they do not treat strategic projects any differently than projects that do not have strategic value.

5.4.1 Frequency of Hurdle Rate Changes

52.5% of the firms in our sample have indicated that they did not change their hurdle rates in the past three years. Approximately one fourth of the corporations have adjusted their numbers once (24.6%), and slightly more firms (31.1%), more than once. The evidence from the existing survey literature shows that U.S. firms schedule reviews of their hurdle rates with some regularity. In addition, they apparently re-estimate their cost of capital in case of significant events, such as mergers and acquisitions. Brigham (1975) finds that 13 of 33 companies (39%) change hurdle rates more frequently than once a year. For 32% of the companies the frequency of hurdle rate revisions "depends on conditions". Gitman and Mercurio (1982) reports that 24.3% of the 127 respondents in their survey change their cost of capital annually, 24.3% less frequently than annually, and 21.5% change their hurdle rates "whenever environmental conditions warrant reevaluation". Bruner, Eades, Harris, and Higgins (1998) report that 37% of their survey firms re-estimate cost of capital on an annual basis. While our survey results on firm practices regarding the frequency of hurdle rate changes are somewhat in line with the earlier surveys, the finding that approximately one half of our survey firms have not changed their hurdle rates 3 years prior to the time of the survey is not comforting, especially since there were significant developments in the capital markets during 2000-2003 time period. At the beginning of this period stock prices increased significantly, but later on declined dramatically as a result of the bursting of the "internet bubble". Thus, firms that did not adjust their hurdle rates

accordingly possibly suffered from both an underinvestment and overinvestment problem during this time period.

According to an article in the *Economist*, 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".[7] While U.S. firms may fare better in adjusting their hurdle rates relative to European firms, given the serious consequences of under/over investment problems generated by the non-revision of hurdle rates in line with changes in market conditions, the potential damage inflicted by over half of the firms in our survey is probably significant.

In our survey we asked what significant factors would lead firms to change their hurdle rates. Table 5 summarizes how respondents answered this question. On a scale of -2 (not important at all), to 2 (very important), cost of capital factors in the form of interest rate changes (considered to be very important by 39% of the survey respondents), and changes in the expected risk premium (very important for 33% of the respondents) were ranked highest. On the other hand, variables reflecting the state of the economy, such as cyclical changes in the economy and political uncertainty (9% and 6%, respectively) are not considered to be very important. These findings appear to be reasonable. In general, the responses imply that since sensitivity of a firm's fortunes to the cyclical phases of the economy, and its sensitivity to changes in the political environment would already be factored in its beta. Thus, only changes in financial variables such as in interest rates changes (affecting both cost of debt and cost of equity), and changes in risk premia (affecting cost of equity), should cause firms to adjust their cost of capital.

Additionally, survey participants find the strategic versus non strategic nature of the projects, and the size of the project to be somewhat important factors (mean values of 0.70 and 0.68, respectively) in the determination of hurdle rates. They also find market risk to be more important than project specific risk (0.86 versus 0.68).

[7] See "How high a hurdle?", Economist, May 8, 1999.

5.4.2 Multi-segment Firms and Use of Firm-wide versus Divisional Hurdle Rates

We asked firms with multiple divisions or business segments to indicate how often they use a company-wide hurdle rate on a scale from -2 (never) to 2 (always). As is displayed in Table 6**,** more than half of the 76 respondents (53.9%) gave an answer of "always" to this question, with a mean value of 1.24. It appears that multi-divisional firms by-and-large do not use proxy firms to determine their divisional hurdle rates. Only 13.8% of the respondents indicated that they always used the hurdle rate of other firms in the particular industry that their division operates (the mean value is -0.45). We then refined our question further by asking them if they adjusted proxy firm data to their divisions by taking into account differences in leverage, tax rates, and costs of debt. Only 8.3% of the respondents always followed such a procedure (mean value is -0.82)

Earlier studies report similar findings. In Bierman's (1993) sample, 61.8% of the firms report that they use their firm-wide hurdle rate for all divisions. Apparently, only 26.5% of the firms report that they use project-risk adjusted hurdle rates. He also finds that only 35% of the firms would ever consider using divisional rates, and just 6% of the CFOs rank divisional cost of capital to be an important issue.

In Brigham (1975), 45% of the 33 respondents answer that they use one hurdle rate to screen all projects throughout the company. Rosenblatt (1980) finds that 14 of the 21 firms use the same cut-off rate for all divisions. Gitman and Mercurio (1982) summarize previous findings and conclude that one third to half of the companies do not adjust hurdle rates for different projects. Their own results confirm this in that 33.3% of their survey firms do not adjust hurdle rates for divisional risk. Thus, the findings from our survey and earlier surveys show that corporate practices in this respect has not changed that much during last 20 years or so. In fact, there is other (anecdotal) evidence which shows that similar practices on this issue are not uncommon even in the case of well-known multi-national firms.[8]

[8] The *Economist* article cited in the previous footnote states that "…Siemens, a German industrial giant, last year started assigning a different hurdle rate to each of its 16 businesses, ranging from household appliances to medical equipment and semiconductors. The hurdle rates - from 8% to 11% - are based on the volatility of shares in rival companies in the relevant industry…"

The distortions caused by use of firm-wide hurdle rates for divisional projects are well known. Such behavior results in overinvestment in risky divisions and underinvestment in low risk divisions, since firms are likely to accept some negative NPV projects in high risk divisions and reject some positive NPV projects in low risk divisions. In addition to shareholder wealth destroying implications, not using divisional hurdle rates would also increase the risk profile of firms unintentionally due to use of firm-wide cost of capital, since capital would be allocated disproportionately, away from low risk divisions to riskier divisions.

6. Interactions between Cashflows and Hurdle Rates

The results displayed in Table 2 shows that 68% of the firms calculate either levered or unlevered cashflows correctly. In this section, we first examine whether or not they match the cashflows they use with the appropriate discount rate. The intersection of two survey questions on cashflows and discount rates is displayed in Table 7. While 71.3% of the firms that responded to both questions use WACC as their hurdle rate, and 44.4% of the firms use unlevered cashflows, only 34.8% of the firms choose the correct combination by matching unlevered cashflows and WACC in evaluating investment projects. 18.3% of the respondents apparently make the mistake of discounting levered cashflows at their WACC. While 24.4% of the firms use levered cashflows, apparently only 1 of those firms makes the correct decision of discounting levered cashflows at the levered cost of equity.

We next investigate whether firms incorporate expected inflation consistently in project cashflows and hurdle rates in Table 8. The table shows that 66 (out of 127) of the respondents use nominal cashflows and 50 of them use nominal hurdle rates. The Table also shows that 29.8% of the respondents use both nominal hurdle rates and nominal cashflows. Similarly, while 50.4% of the respondents rely on real cashflows and 58.7% employ real hurdle rates, the real hurdle rate / real cashflow combinations represent 38.4% of the firms. Overall, our survey firms display a good record on how they deal with the inflation issue since 68.2% of the sample

incorporates inflation into their analysis correctly by either using nominal cashflows/hurdle rates or real cashflows/hurdle rates combinations.

When survey participants were asked whether they incorporated risk by adjusting the hurdle rate upwards or by adjusting project cashflows downwards the results not displayed here shows that 63.2% of the firms indicated that they make the adjustment in the hurdle rate (important or very important) while 67.5% make cashflow adjustments (important or very important).

Next, we discuss the findings regarding foreign investments of U.S. firms. Results not displayed here indicate that 50.9% of the participants think foreign projects are riskier than similar domestic projects. For foreign projects, 35.1% of the respondents would use higher hurdle rates than they would use in similar domestic projects. The response of 15.8% is that they would incorporate the implied higher risk of foreign projects by using more conservative cashflow projections. 40.4% of the firms, on the other hand, indicated that they would neither use higher hurdle rates nor more conservative cashflows in their evaluation of foreign projects, implying that close to half of the survey firms do not consider foreign projects to be riskier than similar domestic projects.

The survey results also show that 90.3% of the firms handle cashflow/hurdle rate combinations in evaluating foreign investments correctly: 50% of the firms indicated that they would evaluate both foreign project cashflows and hurdle rates in dollar terms, while 40.3% would consider both the cashflow and hurdle rate components of foreign investments in foreign currency denominated terms.

7. WACC computations for the Survey Firms

In this section we compare the self-reported hurdle rates (which are cast in WACC terms) with the WACC we compute for the survey firms using CRSP and Compustat data. Additionally, for firms where before-tax cost of debt data is missing we make assumptions to fill the missing data. We also explain how we develop tax rate data for the survey firms. We start our WACC

computations for the survey firms by first calculating their cost of levered equity. Later on we discuss how we compute before-tax cost of debt, tax rates, and the weights for debt and equity.

7.1 Computing Cost of levered equity Using CRSP and Compustat Data

Needless to say, an important component of WACC is the levered cost of equity. 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 capital has been the CAPM.[9] Graham and Harvey (2001) report that 73.5% of the 392 respondents to their survey use CAPM "always" or "almost always". Their findings also show that only a small number of firms implement more complex, multi-factor models. In contrast, earlier surveys show that CAPM was not widely used (e.g., Gitman and Forrester (1977) and Gitman and Mercurio report that only approximately 30% of the firms in their surveys rely on CAPM in computing their cost of equity). The increased use of CAPM over time can be seen in Figure 3. In order to avoid the potential contamination of the data that can be caused by the social desirability hypothesis, we did not directly ask the participants if they used CAPM. Instead, in the hurdle rate related questions, we gave them various choices, some of which involved CAPM related considerations[10]. The responses show that the use of CAPM is widespread in 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"(i.e., the beta coefficient). Similarly, very high proportion of the respondents argued that "interest rate changes" and "changes in stock market returns" would play important roles in their decision to change their hurdle rates.

We chose proxies for the risk free rate and the equity premium that are on the high side. The choice of high values for the two CAPM inputs was made in order to be sure that the hurdle premium we find is not an artifact of our assumptions that would produce low values for the cost

[9] This has been different before as Figure 1 documents. In Gitman and Mercurio (1982) only 21.5% of the firms indicate that they use CAPM in capital budgeting to assess cost of capital. At that time sensitivity analysis (37.9%) and simulation (20.9%) were among the most widely used methods.

[10] For example, rather than using the word beta, we asked them whether their hurdle rates were related to "...sensitivity of project returns to economic conditions", and whether they would change hurdle rates if "interest rate changed" and if "tax-rates changed", etc.

of levered equity. The mean life of a typical project for firms in our survey sample is 6.7 years. Partially for this reason, we used the 10-year Treasury bond rate, which was 4.3% at the time of our survey, as a proxy for the risk free rate.[11]

For the equity premium we used 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)).[12] This value is similar to the textbook suggestion of Brealey and Myers (2000, p.160) that using a premium in the range of 6 to 8.5% seems reasonable. The equity premium we use is also in line with the 7% figure used by 226 financial economists in the Welch (2000) survey. However, the equity premium we use is significantly higher than the approximately 4% figure that is suggested by the forward-looking approaches of Blanchard (1993), Wadhwani (1999), Fama and French (2001), and Jagannathan, McGratten, and Scherbina (2001). The equity premium we use is also higher than the survey findings of Bruner, Eades, Harris, and Higgins (1998).[13] The lower risk-premium figures used in recent studies are based on data that shows historical equity premia declined during post 1990 period. In sum, the equity premium we use may be biased upwards and thus, may produce data for computed-WACC that is "too high".

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 obtaining betas using various alternative estimations. The various estimates we obtain involve different combinations of data frequencies (daily, weekly, and monthly), and length of time period for estimating the model. To increase the accuracy of the market model estimation, a sufficiently large number of observations is needed. One obvious way to increase the number of observations is to estimate the model using a longer time period. However, the disadvantage of this 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

[11] 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. They report that only 4% of the firms in their survey used the 90-day T-bill rate

[12] Using the arithmetic mean instead of the geometric mean also results in a higher estimate of the equity premium.

[13] They report that 37% of the 27 firms in their sample use a figure in the range of 5-6%, and 11% of the firms use market premium which is below 5%.

macro-economic fluctuations. Thus, this procedure may produce beta coefficients that represent stale measures of a firm's systematic risk. To avoid the staleness problem, the estimation time period may be shortened. In this case, to obtain a sufficient number of observations, the returns data needs to be measured at a higher frequency. However, increasing the frequency of data may have its own problems since such data tends to be noisy, especially for infrequently traded stocks. For this reason, we have estimated the market model using various time period and frequency combinations. We also used some additional alternative estimation procedures.

The market model in practice is typically estimated by running a regression of stock returns against market index returns. Even though the underlying theory of CAPM dictates the use of excess return of all risky assets as the explanatory variable, the standard practice is to use returns on a market index like the S&P 500 (Bloomberg, Ibbotson, Merrill Lynch, Reuters, or Standard & Poor's) or the NYSE composite index (Value Line). We obtained estimates for beta coefficient by using the following alternative procedures:

(1) Regressing five years of monthly returns on returns of the S&P 500. This is the baseline calculation for most service beta providers (Ibbotson, Merrill Lynch, Standard & Poor's).[14]

$$r_{i,t} = \alpha_i + \beta_{i,0}\, r_{m,t} + \varepsilon_t \qquad (1)$$

(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

$$\text{adjusted beta} = \text{raw beta} \times 0.67 + 1.00 \times 0.33$$

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

(3) Estimating the beta coefficient where two years of daily returns are used. For daily returns we include four lagged daily market returns in our specification. We require a minimum of 60 observations from January 2002 to December 2003, which excludes just one firm.

[14] 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.

(4) To reduce the nontrading bias when using daily data we also estimated 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. The beta coefficient we obtain from this procedure is sum of the five estimated beta coefficients in the following equation:

$$r_{i,t} = \alpha_i + \sum_{j=0}^{4} \beta_{i,j}\ r_{m,t-j} + \varepsilon_t \qquad (2)$$

(5). Beta estimation obtained from two years of weekly data.

(6) In order to mitigate the potential problem that for some firms the R-squares obtained from the market model may be low, we calculate the industry beta at the two-digit SIC code level. We then use the equally weighted average industry beta to represent the beta coefficient of the individual firm that has the same two-digit SIC code.

(7). Representing beta as the weighted average of the two estimation methods above where monthly data is used (i.e., models (1) and (6)). We computed the weights based on the R-squares of the two models. This procedure can be written as:

$$\text{weighted beta} = \frac{R^2_{firm}}{R^2_{firm} + R^2_{industry}} \beta_{firm} + \frac{R^2_{industry}}{R^2_{firm} + R^2_{industry}} \beta_{industry} \qquad (3)$$

Table 9 displays the summary statistics for beta coefficients obtained using the methods described above. The range of betas we compute gives us some idea about how different the estimates are. The mean range of the estimated beta coefficients is 0.81 (median 0.75) with a standard deviation of 0.34. Pairwise simple correlations of estimated beta coefficients are reported in Table 10. As can be seen in this table the pairwise correlation coefficients are relatively high with the exception of industry beta coefficients. Nevertheless, given that there is some small dispersion in the estimated beta coefficients, calculating WACC and hurdle rate

premium on the basis of different beta estimates appears to be justified since it enables us to check the robustness of the hurdle rate premium we document.[15]

Excluding the beta estimates obtained from weekly and daily data due to potential noise problems at these frequencies, the range of betas obtained from models (1), (2), (5), (6), and (7) is 0.93 to 1.01, with an arithmetic average of 0.95.[16] **(Iwan, since we argue that it is not a good idea to rely on betas obtained from models (3) and (4), why do we waste space in having them in the Tables? Why can't we have a footnote saying we calculated these betas and they resulted in betas of 0.69, and 0.73. But we don't "trust" these numbers due to the noise issue. And that the reason we keep Model (5), in spite of the fact that it uses daily data, is because we take care of the noisy estimates problem by using 4 lags. Thus, I think we should eliminate columns 3, and 4 in Tables 9, 12, and 13. Also, as we talked on the phone, I don't think we need column 8 of the same Tables)** Based on this data, it appears that our survey firms are fairly representative of the market. In the empirical tests we conduct we report results where the beta is estimated from the market model that uses monthly returns over a five year period (i.e., Model (1)). This choice is based on the fact that this particular estimation method is most commonly used in empirical studies that use CAPM. The estimated cost of levered equity based on the five models mentioned above ranges from 10.42% to 10.93%, with an arithmetic mean of 10.57. The mean of the cost of levered equity based on the beta estimate we use is 10.42% (the median is 9.76%). Given, the narrow dispersion of beta estimates obtained from the above 5 models, it is not surprising that (unreported) tests where we employed the other four beta estimation procedures produce remarkably similar results.

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

As discussed earlier, a very high percentage of the 117 respondents (71.8%) indicate that the hurdle rate they report in the survey represents their WACC. We compute the WACC of these firms by using Compustat data. We discuss below the details of these calculations and the

[15] Since adjusted beta is just a scaled version of the beta from 5-year monthly data, correlations coefficients for the two measures are the same. The same conclusions result when Spearman rank order correlations are used.
[16] We included the 5th model since under this procedure we include four lags in order to alleviate the problem of potentially noisy estimates.

assumptions we used. We were able to obtain computed or "true" WACC for 83 firms for which we had matching Compustat and CRSP data. In section 8 we compare the self-reported WACC based hurdle rates with computed WACC for 70 firms for which we have matching data for both of self-reported and computed WACC.

In our computations, we made some assumptions, in some cases, on the cost of debt and tax rate components of WACC. For before-tax cost of debt we used the survey participants answer to our question regarding what the interest rate on their senior debt is. We do not know whether their answer referred to the coupon rate or the yield to maturity of their senior bonds. Thus, for firms that have not recently issued debt, it is possible that their answers do not reflect the marginal cost of debt for participants that may have used their coupon rate in their response. However, given that the secular decline of interest rates started in the late 1990s and continued during the early 2000s, this should work against finding a hurdle rate premium. The cost of debt figure used in WACC calculations should of course represent the marginal cost associated with the portfolio of firms' borrowings, and not just senior debt. To rectify the potential problems in cost of debt figures, we attempted to use Compustat to obtain the bond ratings of survey firms and use the applicable rates at the time of the survey. However, we were unable to obtain sufficient bond rating information on long-term debt for differing maturities and seniorities. As a result, we ended up using the survey participants' responses as the before-tax cost of debt. 88 respondents supplied data on their before-tax cost of debt. Using Compustat data, we checked whether firms that left the interest rate question blank had any long-term debt. Out of the 39 non-responding firms, 15 did not have long-term debt. Obviously, in the case of these firms, their cost of unlevered equity represents their WACC. However, our check also revealed that 13 firms had debt even though they left the interest rate question blank. For these firms we used their Z-scores 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 assigned the 10-year Treasury bond rate in effect at the time of the survey plus 1 percent (5.35%). For the 2 firms with Z scores of less than 1.81 (financially unhealthy firms), we assigned the 10-year Treasury rate plus 4 percent (8.35%). Finally, firms that have Z-scores in the interval between 1.81 and 3 (2 firms) were assigned a before-tax cost of debt of 6.35%. Finally, 16 firms reported a rate below the 10-year Treasury

rate (4.3% at the time of the survey). In the case of these firms, we added a spread of 0.5%. Therefore, all our WACC calculations assume a long-term debt rate of at least 4.8%.

We calculated a firm's tax rate by dividing total income taxes (Compustat item #16) by income before taxes (Compustat item #170). When item #16 or #170 was negative we set the tax rate to zero. The tax rate we obtain in this manner, of course, reflects a firm's average and not marginal tax rate. However, we were unable to obtain sufficient number of observations on marginal tax rates. We also classified an observation as "missing" when #170 is zero. Finally, we capped the tax rate at 34 percent. The summary statistics on the before-tax cost of debt and the tax rate data we used in our WACC computations are presented in Table 11.

To compute the weight of debt, we divided total debt (item #9 plus item #34), by total debt plus market value of equity (product of number of shares (item #199) and end of year stock price (item #25)). For weight of equity we used (1- weight of debt). The weights used in calculating WACC should be based on target rather than current capital structure. Due to lack of data on target capital structures we assumed that the current capital structure is also the target capital structure. 30.1% of the firms in our sample indicated that they do not plan to change their capital structure during the next three years, while 24.4% were planning on a higher levered capital structure, and 45.5% had the intention of using less debt in the future. While we do not know the exact planned debt-to-equity ratios, these figures indicate that using the current capital structure weights as proxies for target rates probably does not bias the WACC calculations significantly.

Table 12 displays the summary statistics on our computed WACC. Since we used different beta estimates in finding the cost of levered equity, different columns of this table report computed WACC data that uses beta estimates reported in the corresponding columns of Table 9. This table shows that computed WACC means range from 8.42% to 11.25% (the median is in the 8.16-10.04% range) depending on the beta coefficient used. These nominal mean rates correspond to real rates of 6.22 – 9.15%. The arithmetic average of the eight different costs of capital calculations has a mean of 10.51% in nominal terms and 8.31 in real terms. Skewness and kurtosis statistics reported for the various WACC calculations indicate that, by and large, the distributions of WACC are symmetric and that the observations are centered around means and

medians. In the empirical tests we perform for computed WACC, we use the data shown in column (1). This figure is based on beta coefficient estimates that are obtained from estimating the market model using 5 years of monthly data.

8. Self Reported Hurdle Rates versus Computed WACC: The Existence of a Hurdle Rate Premium Puzzle

Table 13 shows that self reported WACC based hurdle rates exceed their "true" (i.e., computed) WACC. We find that the mean difference is around 5 percent for the different beta measures employed. We refer to this difference as the "hurdle rate premium". The table also shows that even if the maximum computed WACC figure is used, the hurdle premium is still large at 3.30%. Furthermore, any doubt about the presence of the hurdle rate premium is dispelled after comparing the computed cost of levered equity means (and medians) with self-reported hurdle rates. The summary statistics (not displayed here) reveal that self-reported hurdle rates exceed the cost of levered equity we computed by anywhere between 4.59%, and, 6.08% **(Iwan, as we talked on the phone, these numbers need to be corrected. Since lowest WACC premium is 4.68, lowest levered equity premium cannot be 4.59. You thought that maybe we did not update the equity premium regressions when you updated the hurdle rate premium regressions when I was in Montreal)** Cost of levered equity represents an upper bound of what the hurdle rate should be. The fact that self reported cost of capital (expressed in WACC terms) exceeds even the more expensive component of computed WACC provides strong evidence that hurdle rates used in practice are a lot higher than what most people would assume.

Having established the existence of the hurdle rate premium, in the next two sections we empirically examine what factors could explain this hurdle rate premium puzzle. Later in the paper we discuss some scenarios that may be consistent with this puzzle.

8.1 Investigation of the Hurdle Rate Premium Puzzle

On the basis of the data displayed in Table 13, it is clear that self-reported hurdle rates have two components: The "true" (computed) WACC, plus the hurdle rate premium. In sections 8.2 and

8.3, we investigate the hurdle rate premium puzzle by running two sets of bivariate regressions on self-reported hurdle rates and computed WACC using the same explanatory variables. Our purpose in doing this is to examine if the same set of variables influence both hurdle rates and computed WACC, and also to find compare the extent of the influence of the explanatory variables on the two discount rates in question. In these regressions, we use variables that measure risk and variables that are related to risk. Additionally, we run the regressions against explanatory variables that reflect the financial health of firms as well as the survey participants' perception of the degree of managerial and capital market constraints their firms face. The outcome of the two sets of regressions has the potential to shed some light on what could explain the hurdle rate premium puzzle. In fact, the two sets of regressions essentially show that similar set of risk related variables explain the two components in question, but to a different degree. Finally, in section 8.4, we examine the hurdle rate premium puzzle directly, by running regressions on the hurdle premium itself. We already use the standard risk and leverage related variables in explaining the two components of the hurdle premium, and as mentioned above, these variables are important for both of the components of the hurdle premium (although not to the same extent). This implies that hurdle rates must also be capturing some subjective considerations not addressed by the theory of cost of capital.

8.2 Self-reported Hurdle Rate Regressions

In this section we examine the determinants of the hurdle rate by estimating bivariate regressions of hurdle rates on various risk and other financial variables. These results are displayed in columns 2-5 of Table 14. Hurdle rates do not appear to be related to firm size (neither when measured as log of total assets nor log of sales). We included firm size in the regression based on the possibility that larger firms may be able to raise funds at a lower cost than smaller firms. However, the statistical insignificance of the size variables indirectly supports the view that larger firms do not necessarily have easier access to external funds (or that firm size is not a good proxy for capital market access constraints). Respondents' view of whether or not their firms have managerial or capital constraints, also are not correlated with hurdle rates. This could indicate that such constraints are not important enough to play a role in the determination of hurdle rates. However, the constraints in question could be important for some of the survey

sample firms. For example, when we asked the respondents to rate the importance of "whether the project in question requires significantly more funds than the typical project your firm takes" in their hurdle rates, on a scale of -2 (not important at all) to 2 (very important), the mean score was 0.68. However, **(30+x)** percent of the firms considered the statement to be important or very important.

Market-to-book ratio is also uncorrelated with hurdle rates. This is somewhat surprising, because as discussed below firms with high growth opportunities typically also have high risk. Thus, it would be reasonable for such firms to have high required rate of returns. In fact, below we show that market-to-book ratio is positively correlated with computed WACC due to the fact such firms have higher cost of levered equity **and debt (?)**. Thus, the mystery is why the managers of high growth firms do not consider their firms to be riskier than firms with low growth prospects. One possibility is that they do, but at the same time they also interpret their high stock prices to be indicative of low ("cheap") cost of equity either incorrectly or because they consider their stock to be overpriced. Under such a scenario, high hurdle rates implications of high risk may be offset by cheap equity "implication" of high stock valuations.

The results also show that hurdle rates are significantly related to some variables, especially variables that measure firms' risk. The coefficients displayed in Table 14 show that self-reported hurdle rates are positively correlated with both, the beta coefficient and the standard deviation of stock returns. These results indicate that self-reported hurdle rates are related to systematic and total risk. The positive correlation of systematic risk implies that firms use CAPM in setting their hurdle rates. The positive correlation of total risk and hurdle rates could be driven by systematic risk. Alternatively, unsystematic risk may be the reason behind the positive correlation between hurdle rates and total risk. Needless to say, it is also possible that both types risk are important determinants of hurdle rates. To see if unsystematic risk is a significant factor in the determination of hurdle rates, we need a separate measure for this risk. Additionally, In order to judge the relative importance of the two types of risk in question, we need to measure them in a comparable manner. Since beta is the *index* of systematic risk, while standard deviation of stock returns capture the *level* of total risk, the estimated coefficients for these two variables makes their comparison difficult. To make the comparison meaningful, we measure

systematic risk as $\beta_i \times \sigma_m$, and unsystematic risk as $\sigma_i - \beta_i \times \sigma_m$. The results show that independent of how it is measured systematic risk is an important determinant of hurdle rates. However, even though managers appear to use CAPM they apparently, also incorporate unsystematic risk in their hurdle rates.[17] However, judging by the relative size of the coefficients (the estimated systematic risk coefficient is twice as big as the unsystematic risk coefficient) managers appear to consider systematic risk to be much more important. To further examine the importance of systematic versus unsystematic risk we run a regression of hurdle rates on both systematic and unsystematic risk. The results displayed in Table 15 show that when systematic risk is controlled for, the *t*-statistic for the unsystematic risk coefficient drops from 2.59 (the bivariate regression) to 1.89 (*p*-values increase from 0.012 to 0.063). Given that R-squares increases from 0.09 (in both systematic and unsystematic risk bivariate regressions) to 0.13 indicates that unsystematic risk still has some incremental explanatory power when both types of risk are in the estimated regression. The relative importance of systematic risk over unsystematic risk in the determination of hurdle rates is also supported by survey results. As we mentioned in the discussion of Table 5 before, when the participants are asked to judge the importance of systematic and unsystematic risk in the determination of their hurdle rates, the mean value for the answers indicates that CFOs consider systematic risk to be more important relative to unsystematic risk (mean values of 0.86 versus 0.68).

The results in Table 14 show that our computed WACC variable is also statistically significant in the hurdle rate regression. This supports the survey participants' claim that their hurdle rate reflects their WACC. However, the fact that R-squares is only 0.18 in this regression, possibly indicates that factors other than firms' WACC shape their hurdle rates (or that they do not compute their WACC in the textbook manner).

The estimated coefficient for debt-to-assets ratio is also statistically significant. At first, the negative sign of the estimated coefficient for D/A may seem counter intuitive since higher D/A means higher level of financial risk, which should lead to higher hurdle rates. However, the negative sign implies that on average the tax advantage of debt dominates costs of financial

[17] There is some evidence reported in the literature that unsystematic risk plays a role in the determination in the required rate of return of investors. See for example, Goyal and Santa-Clara (2003), Barberis and Huang (2001), Malkiel and Xu (2001), and Lehmann (1990)

distress for the amount of leverage employed by our survey firms. In other words, the sign is consistent with the argument that the amount of leverage they employ reduces their cost of capital due to the interest-tax shields, and this reduction is not offset by the costs of financial distress created by higher leverage. Under such conditions hurdle rates would decline as debt usage increases.

The positive relationship between current ratio and hurdle rates confirms Poterba and Summers (1995), who also find a positive connection between real hurdle rates and this liquidity ratio. It is not obvious why firms with high liquidity would have higher hurdle rates. However, it is possible that firms that are blessed with high and profitable growth opportunities maintain a high level of liquidity because high growth opportunities typically involve higher levels of risk. If this is the case, it would be reasonable for high-risk, high-growth opportunity firms to maintain high level of liquidity. As we will elaborate below, if firms that are blessed with many profitable opportunities may be unable to take all positive NPV projects due to either managerial and/or capital market constraints. In such an environment they may use high hurdle rates as a rationing device.

Another significant result displayed in Table 14 is that firms that have changed their hurdle rates at least once during the three years prior to the survey date have lower hurdle rates. This appears reasonable in light of the fact that during the time period prior to the survey date, both stock and bond prices were displaying a general rising trend. Thus, it would make sense that firms that adjusted their hurdle rates three years prior to the survey date would be using lower hurdle rates than firms who did not adjust their hurdle rates.

In sum, while Poterba and Summers (1995) find only the current ratio to be statistically significant in the determination of hurdle rates (e.g., they find that even the beta coefficient is not related to hurdle rates), we find that a significant number of variables, especially risk related variables, to be important in explaining hurdle rates. Furthermore, all the statistically significant coefficients appear to have the "correct" sign.

8.3. Computed WACC Regressions

We run bivariate regressions to find the determinants of the WACC. The results we obtain are displayed in columns 5 to 7 of Table 1.

Comparison of columns 2-4 and 5-7 reveals that in terms of significant explanatory variables, the self-reported hurdle rate and computed WACC regressions are remarkably similar. Just like it was the case in the self-reported hurdle rate regressions, beta, standard deviation, measures of systematic and unsystematic risk we use, and the current ratio are all positively correlated with computed WACC. In addition, while market-to-book ratio is statistically insignificant in the hurdle rate regression, it is positively correlated with the computed WACC. Furthermore, coefficient of variation of EBITDA is negatively correlated with computed WACC.[18] Debt-to-asset ratio is negatively correlated in the hurdle rate equation. While this variable has the same sign in the computed WACC regression, it is not statistically significant. The variable indicating that firm adjusts its hurdle rate for risk does not appear to be correlated with computed WACC. In section 8.2, we provided an explanation for why this variable may be correlated with the self-reported hurdle rates. However, the insignificant coefficient for this variable in the computed WACC equation is as expected since there is no reason why there should be any connection between the current WACC of a firm, and whether or not it is in the habit of adjusting its hurdle rates for risk.

As was the case in the hurdle rate regression, firm size, and variables that are designed to capture the respondents' views on whether firms have managerial or capital constraints, are insignificant in the computed WACC regressions as well.

While both systematic and unsystematic risk is positively correlated with computed WACC, judging by the size of the coefficients systematic risk is much more important than unsystematic risk (systematic risk coefficient is more than 4 times bigger than the unsystematic risk coefficient). Furthermore, the difference in R-squares (0.79 when systematic risk is the explanatory variable, versus 0.19 when the left-hand-side variable is unsystematic risk)

[18] Needless to say, our WACC calculations should not be related to the dummy variable used to capture their response regarding the frequency of their hurdle rate changes.

reinforces the same conclusion that systematic risk is more important than unsystematic risk in explaining computed WACC. However, this is not a surprise at all since we explicitly use CAPM to compute WACC. Obviously, systematic risk should have a much higher explanatory power in Computed WACC than self-reported hurdle rates. The R-squares reported in Columns 4 and 7 of Table 14 confirm this to be the case (0.79 for computed WACC equation versus 0.09 for the self-reported WACC equation). While it is not completely surprising that unsystematic risk plays some role in the determination of self-reported hurdle rates, it is somewhat surprising that unsystematic risk is statistically significant in the computed WACC regression. The computations of WACC reflect what the hurdle rates *should* be, while survey responses show what the respondents actually *believe* them to be. Thus, it is possible that managers may lose sight of the fact that shareholders have diversified portfolios and consider unsystematic risk to be important. But, since WACC computations explicitly use CAPM to infer cost of levered equity, it is surprising that unsystematic risk has a statistically significant coefficient in the computed WACC regressions. In fact, even when both systematic and unsystematic risks are used as RHS variables, the estimated coefficient for unsystematic risk is still statistically significant. However, Table 15 shows that in this case while the coefficient for systematic risk in the bivariate regression and the multiple regression essentially remains unchanged (0.29 versus 0.28), the coefficient for unsystematic risk declines (from 0.07 to 0.02). Additionally, the R-squares which is 0.79 in the bivariate regression for systematic risk increases to only 0.81, indicating that unsystematic risk does not have much of an incremental explanatory power.

The apparent role played by unsystematic risk in computed WACC raises an interesting question: what component(s) of WACC is (are) influenced by unsystematic risk? In other words, does the effect of unsystematic risk on computed-WACC flow through the before-tax cost of debt, cost of levered equity, or the weights (or some combination)? **Here I should discuss results from the following regressions: LHS vars= B-T cost of debt, D/A. RHS vars.=Syst. Risk, unsyst. Risk, and both.** While the results indicate that unsystematic risk may play a significant role in hurdle rates, and a minor role in computed WACC (mostly via the cost of debt component of WACC), it should not be the case that it plays any significant role in the computed cost of levered equity. However, the evidence on this issue is somewhat mixed. As expected, systematic risk is highly significant when regressed against the cost of levered equity, but the

estimated unsystematic risk coefficient in the bivariate cost of levered equity regression is also statistically significant **(however, it is possible unsystematic risk is positively correlated with D/E, which we know is in the cost of levered equity computation. Iwan will check whether or not this is the case)**. However, when both risk measures are used as RHS variables, the estimated coefficient of unsystematic risk becomes statistically insignificant. Thus, it can be argued that the effect of unsystematic risk on computed WACC must mostly come via its effect on cost of debt, or weights (or both) components of WACC.

We mentioned above that market-to-book ratio is positively correlated with computed WACC. Market-to-book ratio probably is the most commonly used variable for capturing the growth opportunities of firms. It appears that higher growth opportunities increase firms' computed-WACC. This result is not unreasonable since typically high growth opportunities are correlated with high levels of risk. Thus, firms with high growth opportunities are likely to have higher betas, and thus, higher cost of equity (perhaps even higher cost of debt). To explore these possibilities we regressed market-to-book ratio against cost of levered equity and against before-tax cost of debt in two separate bivariate regressions. The results showed that the growth prospects proxy in question is positively correlated with cost of levered equity with marginal level of statistical significance (*p*-value is 0.092). (**M/B ratio was also positively correlated with cost of debt (?) implying that high M/B firms have high default risks).**

(I stopped here. December 10, 2005).

8.4. Determinants of Hurdle Rate Premium

Table 14 in columns 8-10 also displays the results we obtain from estimating the hurdle premiums. In these regressions we exclude risk related variables. As we discussed above, these variables play much important roles in the determination of computed WACCs than they do in explaining self-reported hurdle rates. Given that hurdle premium is defined as self-reported hurdle rate minus computed WACC, if these risk variables are included in the hurdle premium regressions, they will have negative coefficients. However, these coefficients would have no meaningful economic interpretations. In other words, the estimated negative sign for risk variables would not imply that hurdle premium declines as risk increases, since the results in question would be generated by construction.

The significant variables in the hurdle premium are current ratio, whether firms increase hurdle rates to account for risk, and price to EBITDA multiple. It appears that liquidity of firms as measured by their current ratio is positively correlated with hurdle premiums. Above we explained why highly liquid firms may have higher hurdle rates. Apparently, this factor is not captured fully by the computed WACCs (even though it is statistically significant), thus, the higher a firm's liquidity, the higher the additional return (above computed WACC). Price–to-EBITDA ratio is negatively correlated with hurdle rate premium. It appears that the higher the valuation that investors put on firms the lower is the hurdle rate used compared with computed WACC. Normally, higher valuations of firms will be correlated with both, high growth opportunities and high risk. Thus, the implication is that this risk is overrepresented in WACC compared with managers' assessment of the risk in question. We provided an explanation for why adjusting for risk is positively correlated with hurdle rate. Apparently, this adjustment factor is not fully reflected in WACC computations. As a result managers' subjective assessment of the risk in determining hurdle rates exceeds the objective assessment of this risk in WACC computations. Given that the adjustment is subjective, it would not be surprising that the hurdle rate premium would be correlated with the risk assessment factor either positively or negatively. In the case of our sample, apparently the managers adjust hurdle rates to higher levels than investors do.

8.5. Possible Explanations of the Hurdle Premium

A possible explanation of the hurdle premium puzzle is that it may be related to managerial or capital market access constraints as discusses in Meier and Jagannathan (2002). Firms that have a significant number of profitable projects may not undertake all positive NPV projects due to being managerially constrained. Under such a scenario, firms may use high hurdle rates as a rationing device. Even though survey respondents indicate that they do not believe their firm to be managerially constrained, they may not be able to assess this constraint accurately especially if they are not able to compare their firms with other firms in this respect.

Firms may also use higher hurdle rates due to having capital market constraints. However, the survey participants' response that captures capital market constraint is not statistically significant in the hurdle premium regression. While survey respondents also do not think their firm is capital constraint, we have less reason not to believe them in the case of this constraint because we have data on their Z-Scores, and this objective measure of financial health, which should be correlated with capital market access constraint, is insignificant in explaining both hurdle rates and hurdle premium.

In addition to conducting empirical tests to explain hurdle rate premium, we also asked survey participants some questions that may indicate the reasons behind the existence of hurdle premium. Table 16 exhibits the results we obtained. The statements that a significant number of participants checked as "strongly agree" refer to capital market or managerial constraints. For example, 16.8% of the respondents strongly agree with the statement that they cannot take all profitable projects due to restrictions they face in raising external capital. This perception is also confirmed by the fact that 17.6% of the firms strongly agree with the view that they would accept more projects if they had higher level of internal funds. Finally, 16% of the firms in the survey sample strongly agree that managerial constraints prevent them from accepting all positive NPV projects. In fact, while the percent of participants that make this claim is close to the proportion of respondents who argue that they face capital market access constraints, the mean value for the limits imposed by scarce managerial talent is by far the highest.

9. Capital Structure Decision

We next address survey questions on issues relating to firms' capital structure decision. In particular, we are interested in what considerations play important roles in determining capital structure policy. Towards this end we ask them questions on what they consider the advantages/disadvantages relating to debt and equity are. First, we analyze the responses of the survey participants to these questions. Their answers have the potential to show to what extent the trade-off theory arguments hold in practice. Next, we test the predictions of the pecking-order model, which is the main competitor of the traditional trade-off model. We test the

predictions of pecking-order model by asking the survey participants to rank the order in which they would use various internal and external sources of financing.

9.1 Are Survey Responses Related to the Trade-off Theory Arguments?

Table 17 displays the results we obtained for the corresponding survey questions. These questions were designed primarily to probe the participants about to what extent their capital structure decisions are related to the predictions of the trade-off model. Participants were told to respond to these questions on a scale of -2 (strongly disagree) to 2 (strongly agree). The factors that generated the largest "strongly agree" responses were to the following statements: that their borrowing decision is driven by preservation of future debt capacity (29.2%), that the advantage of equity is that it provides financial flexibility (29.1%), and that it reduces costs of financial distress (18.6%), that the advantage of debt is due to interest tax shields (27.3%), supporting Modigliani and Miller (1963). Both of the first two factors, of course, represent the importance of financial flexibility in capital structure decisions.

All of the arguments mentioned above are related to the predictions of the trade-off theory. Other findings also support the trade-off model. In particular, the respondents disagree with the following statement: that they borrow to the extent of making marginal interest tax shield become zero. This is not surprising, given the costs of financial distress that may result from the level of borrowing that might be necessary for firms to be in this position. Apparently, they also strongly disagree with the statement that they do not borrow at all in order to avoid costs of financial distress (thus, agreeing with the basic premise that some borrowing enables them to have an optimal capital structure). However, the responses also generated one particularly surprising result that is difficult to explain: 21.2% of the participants strongly agree with the statement that debt would be a cheaper source of funds even if interest payments were not deductible. Another conclusion that emerges from Table 17 is not related to the trade-off model. Contrary to the arguments advanced in the late 1980s that debt is beneficial as a disciplinary device, only 7.8% of the respondents indicated that debt increases operational efficiency.

Table 17 also displays some results that do not support the trade-off model that balances the interest tax shields advantages and costs of financial distress disadvantages of debt. The respondents disagree that they would borrow more if their tax bracket was higher. This counter tax shield argument is further supported by their disagreement that having higher taxable income would encourage more borrowing. While not all the answers strongly support the predictions of the trade-off model, our overall conclusion regarding the results displayed in Table 17 is that by-and-large they are consistent with the arguments of the model in question. Another important observation that emerges from Table 17 is that while the traditional tradeoff theory typically does not consider optimal capital structure decision in a dynamic context, survey participants consider ramification of current borrowing and equity issuance decisions on their future ability to raise capital. This so called "financial flexibility" argument is not a well-plowed topic in academic studies. However, the concept of "building a war chest" (by either accumulating excess cash or having a cushion of future borrowing capacity or both) is mentioned frequently by managers. Thus, it is not surprising that our survey documents the importance of financial flexibility considerations in corporate decisions about their optimal capital structure.

9.2 Testing the Pecking-order Theory with Survey Data

Many studies test the pecking-order theory by conducting empirical analysis that amount to indirect and, perhaps inaccurate tests of the model in question. Typically, the empirical tests conducted are designed to explain to what extent "financing deficit" is funded with debt versus equity. However, these empirical tests have a major difficulty in testing the strong predictions of the theory regarding the order in which firms use financing alternatives that are available to them. While the size of estimated coefficients obtained from these tests may reveal what financing alternatives are used more than others (i.e., their relative importance), the coefficients in question would be unable to reveal the *order* in which the financing choices are made. The fact that a particular source of financing enables firms to raise more funds than another alternative does not necessarily imply whether the more important funding source is used *before* the alternative that raises less money. The studies that test the pecking-order hypothesis in this manner include Frank and Goyal (2003), Shyam-Sunder and Myers (1999), Chrinko and Singa (2000), and Fama and French (2002).

Another problem with the empirical tests conducted in these studies is that they define "financing deficit" as the sum of uses of funds such as capital expenditures, net working capital investment needs, and dividends minus internally generated cashflows. The studies in question then proceed to run bivariate regressions of debt and equity against this "deficit" variable. However, there are two problems with the definition of financing that is used as the explanatory variable. First, subtracting cashflows generated by the firm from the use variables that need to be funded, amounts to assuming that firms deploy internal cashflows *first* before they access external capital markets. While this assumption may appear to be reasonable, the burden of the proof that it is indeed used first, should be on the empirical tests conducted, rather than implicitly assumed by the definition of the "deficit". Second, the empirical tests of the studies in question ignore another important internal source of financing: changes in the level of excess cash balances.

For these reasons, we believe that survey studies are best suited for determining in what order firms use funding alternatives at their disposal. In this survey we do this by providing the survey participants with the full array of internal and external financing alternatives and ask them in what order they use these financing sources. The results displayed in Figure 7 show the responses of participants. In this question participants were given 6 financing choices and asked to rank them from 1 (first choice) to 6. The financing alternatives they were asked to rank were: excess cash balances, short-term debt, long-term debt, operating profits, equity issues, and "other". Only four participants ranked "other", while excess cash balances were ranked by 114 respondents. Long-term debt, operating profits, short-term debt, and equity issues were ranked by 109, 99, 98, and 90 participants, respectively.

Excess cash balance was ranked the highest. On a scale of 1 to 6, its mean ranking score is 1.3, indicating by far that it is the first financing source that survey firms use. The second choice is operating profits which had a mean score of 2.1. Third choice was short-term debt (mean score is 3.0). Long-term debt was close behind which was ranked fourth with a mean score of 3.3. Finally, issuing equity was ranked as the fifth choice, with a mean score of 4.0. These findings provide a very strong support for the predictions of the pecking order theory.

In sum, our survey results, by and large, support the traditional tradeoff model that argues the borrowing decision is made by balancing the tax related advantages of debt with the disadvantages of debt in the form of costs of financial distress. Additionally, our results indicate that corporate borrowings are strongly influenced by financial flexibility considerations. Our results are also consistent with the pecking-order theory. As we stated earlier, surveys probably provide the most direct and accurate approach of testing the pecking-order model. On this account, we believe that our survey findings provide strong confirmation of the predictions of the pecking-order theory. The tradeoff model addresses the optimal capital structure issue and predicts that firms will choose the debt and equity mix such that interest tax shield related gains of debt are balanced against the costs of financial distress brought on by debt. Pecking-order, on the other hand, does not address the optimal capital structure issue explicitly, but rather due to information cost related reasons, predicts that firms will first use internal sources of financing followed by external securities, starting with securities that have low risk, and moving towards riskier securities as the less risky alternatives are exhausted. Thus, the two theories are not necessarily mutually exclusive. Given, the fact that our findings support not only the pecking order model but also the key predictions of the trade-off theory is not contradictory.

10. Conclusions

In this study we examine how firms make their investment and capital structure decisions in practice. Since we know the identity of the sample firms we can combine their survey responses with publicly available data. This enables us to explore to what extent the predictions about what the behavior of managers *should* be is consistent with what their behavior actually *is*. In fact, it is on the basis of such a comparison that we are actually able to document one of our key findings: the hurdle premium puzzle. We document that the self-reported hurdle rates that financial managers use to discount cash flows exceed, on average, computed weighted average cost of capital by about 5%.

Since the whole premise of our paper is to determine how managers behave compared with how they should behave, all of our findings are cast in these terms. Our important findings are as follows: First, in general firms are using the correct (DCF) capital budgeting methods in

evaluating projects. They display somewhat of a mixed record on the cashflow component of their investment decisions. While in general they calculate both levered and unlevered cashflows correctly, they do not always do a good job of forming appropriate cashflow-hurdle rate combinations. Moreover, they do not display a good record in accounting for some cashflow related issues, such as sunk costs and erosion in sales. However, they are very successful in incorporating inflation into their analysis, and also in dealing with the currency denomination issues of foreign investments.

By a wide margin hurdle rates they use reflect what they believe their WACC to be. Given the fact that their hurdle rate is related to systematic risk and computed WACC, implies they use CAPM and the theory of cost of capital. While we have multiple evidence that they do use CAPM, unsystematic risk also appears to play some (lesser) role in the discount rate determination. Some firms appear not to adjust their hurdle rates with sufficient frequency, and also some firms use firm-wide hurdle rates even when they have multiple divisions. Both of these hurdle rate related issues has the potential to create underinvestment/overinvestment problems.

On the topic of the capital structure decision we believe that the paper makes an important contribution. In particular, we find very strong support for the predictions of the pecking-order theory regarding the order in which firms use various internal and external financing alternatives available to them. In the paper, we argue that survey based methodology provides the best path for uncovering evidence on this issue. While our results support the major prediction of the pecking-order model, at the same time, firms' behavior regarding the capital structure decision very closely matches the important predictions of the trade-off theory. The evidence we uncover in favor of both capital structure theories is not contradictory since these two major theories of capital structure are not mutually excusive.

Finally, while we achieve some success in empirically explaining the hurdle rate premium puzzle, and in advancing some arguments that are consistent with the presence of the puzzle in question, we believe that this important finding needs to be examined further in future research. Further examination of this puzzle promises to be difficult, since it probably is the case that the

discrepancy in question is determined by subjective factors. Nevertheless, given its importance it needs to be examined in great detail.

Appendix

A.1 Additional firm characteristics

To compute weighted cost of capital we asked for the rate on senior long-term debt. Some of the respondents express the rate relative to the LIBOR (7 respondents), Prime Rate (3), or Treasury bond rate (1).[19] We use data at the end of October 2003 for these rates to calculate the rate on long-term debt for these firms.[20] The rates for long term-debt range from 2.0 to 12.5% with a mean of 5.9%. Panel A of Figure A.1 shows the full distribution for the 89 respondents to this question. Out of the twenty-one firms answering "N/A" we can infer from Compustat that in seven cases they do indeed have no debt at all, another two firms less than 1%, and yet another five firms less than 10% debt. Four explicitly indicate that they have no debt and ten firms left the answer blank.

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 respondents to this question. One firm is fully owned by senior management.[21] The distribution is illustrated in Panel C.

A.2 Age, experience, and education of the respondents

Figure A.2 summarizes the characteristics of the responding CFOs. Nearly half of the CFOs (44.6%) are between 40 and 40 years old (Panel A). Seventy-eight percent fall into the age group 40-59. The experience in the job is evenly distributed across the three categories "less than 4 years", "5-9 years", and "10 years or more" (Panel B). Two-thirds of the CFOs (65.5%)

[19] LIBOR (London Inter Bank Offer Rate) is the rate of interest at which banks offer to lend money to one another in the wholesale money markets in London. The prime rate is the rate at which banks will lend money to their most-favored customers. The consensus prime rate published by the Wall Street Journal (WSJ) is the most widely quoted prime rate. The WSJ surveys the 30 largest banks, and when three-quarters of them (23) change, the Journal changes its consensus rate.

[20] The 12-month LIBOR rate on October 31, 2003 was 1.48%, the Prime rate 4.00% and the 5-year Treasury bond yield at 3.27%. We choose the 5-year Treasury bond rate as the only respondent expressing the rate relative to Treasury securities reports a typical project life of 5 years.

[21] The number of quantitative responses to this question is 107. The other respondents either checked "Don't know" (16 responses) or left it blank (1). Five answers to this question were either <1%, <5%, or <8%. In these cases we take the exact values 1%, 5%, and 8%. Similarly, the two responses 50%+ and >1% are replaced by 50% and 1%.

graduated from an MBA program and an additional 12.9% hold a non-MBA masters degree or a higher degree (Panel C). 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 asked 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 is year 1982). The histogram in Panel D describes the distribution.

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Table 1: Fraction of firms using discounted cash flow techniques.

The discounted cash flow techniques (DCF) include net present value, adjusted present value, internal rate of return, and the profitability index. The table shows the fraction and the corresponding absolute number of firms (in brackets) using DCF techniques with increasing firm size. Firm size is measured by self-reported sales per year. A total of 126 firms responded to this question.

Sales	# of respondents	DCF techniques first choice	Payback first choice	Payback first or second choice
< $100 million	43	62.8% (27)	23.3% (10)	46.5% (20)
< $500 million	70	70.0% (49)	18.6% (13)	40.0% (28)
> $500 million	53	86.8% (46)	17.0% (9)	35.8% (19)
> $1 billion	37	91.9% (34)	10.8% (4)	35.1% (13)
> $5 billion	13	100.0% (13)	7.7% (1)	15.4% (2)

Table 2: Calculation of cash flows.

The table summarizes the results to the question how firms calculate cash flows when evaluation projects. The questionnaire provided the choice to check one of five alternatives, 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	15.8%
b) earnings before interest and after taxes (EBIAT) + depreciation – capital expenditures – net change in working capital.	56	44.0%
c) earnings.	6	4.7%
d) earnings + depreciation.	6	4.7%
e) earnings + depreciation – capital expenditures – net change in working capital.	30	23.6%
f) Other.	5	3.9%

Table 3: Sunk cost and cannibalization.

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

1. In valuing projects, do you incorporate into the cash flows the money you spent before the period when you make the accept/reject decision?	# of firms	Fraction
a) Yes.	65	52.4%
b) No	59	47.6%
2. 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?		
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%

Table 4: Summary statistics for 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. Out of the 120 respondents to this question, 103 use either WACC, cost of equity, or cost of unlevered equity. For two out of the 17 firms that use either cost of equity or unlevered cost of equity we can not 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 quartile	10.5
75th quartile	15.0
Skewness	1.7
Kurtosis	9.4
N	101

Table 5: Reasons to change hurdle rates and important factors to assess hurdle rates.

The table analyzes which factors are important when changing the hurdle rate(s) and when assessing the level of the hurdle rate(s). The table shows the fraction of the responding firms that consider the factor in question as very important, the mean of all answers on the scale from -2 (not important) to 2 (very important), and the number of respondents. The bar charts in the last column illustrate the means.

	% very important	Mean	N	Not important -2 -1 0 1 2 Very important
1. If you were to change your hurdle rate(s), how important would the following factors be?				
a) Interest rate changes.	38.8%	1.08	121	
b) Cyclical changes in the economy.	8.6%	-0.03	116	
c) Cyclical changes in the industry(ies) you operate in.	22.2%	0.36	117	
d) Changes in political uncertainty.	5.9%	-0.21	118	
e) Changes in the expected risk premium.	33.1%	1.02	121	
f) Changes in the corporate tax rates.	11.7%	0.10	120	
2. How important are the following factors in determining the hurdle rate you use?				
a) Whether it is a short-lived or long-lived project.	10.8%	0.08	120	
b) Whether it is a strategic or non-strategic project.	26.5%	0.70	120	
c) Whether it is a revenue expansion or a cost reduction project.	14.9%	0.26	120	
d) Whether it is a replacement project or a new investment.	16.0%	0.30	119	
e) Whether it is a domestic project or a foreign project.	10.5%	0.01	114	
f) Whether the project in question requires significantly more funds than the typical project your firm takes.	30.0%	0.68	120	
3. 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.	30.5%	0.86	118	
b) Project risk that is unique to the firm and unrelated to the state of the economy.	28.7%	0.68	115	

Table 6: Divisional hurdle rates.

The table reports how firms with multiple divisions or business segments adjust their hurdle rates. In a separate question, a total of 79 firms answered that a they actually have multiple divisions. The table shows the fraction of the responding firms that would always use the method in question, the mean of all answers on the scale from -2 (never) to 2 (always), and the number of respondents. The bars plot the means.

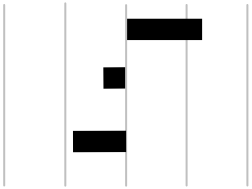
If you calculate the hurdle rate for a division/business segment, do you	% always	Mean	N	Never -2 -1 0 1 2 Always
a) use the company-wide hurdle rate.	53.9%	1.24	76	
b) use the hurdle rate of firms that are in the same industry as the division in question (proxy firms).	13.8%	-0.45	58	
c) adjust the industry hurdle rate of proxy firms for tax rate, cost of debt, capital structure, etc., differences between your firm and proxy firms.	8.3%	-0.82	60	

Table 7: Consistency between hurdle rate and the calculation of cash flows.

The rows of the cross-tabulation indicate what the self-reported hurdle rate represents and the columns denote five different ways to calculate cash flows, (i) to (v), plus the "other" category. Each cell then displays the absolute number and the fraction of all 113 respondents for a given combination of what the hurdle rate represents and how the firm calculates its cash flows when evaluating a project.

The definitions of the cash flow calculations (i)-(v) are as follows:

(i) Earnings before interest and after taxes (EBIAT) + depreciation
(ii) Earnings before interest and after taxes (EBIAT) + depreciation – capital expenditures – net change in working capital
(iii) Earnings
(iv) Earnings + depreciation
(v) Earnings + depreciation – capital expenditures – net change in working capital

Hurdle rate	Cash flow calculation						
	(i)	(ii)	(iii)	(iv)	(v)	Other	Total
WACC	11.3%	34.8%	1.7%	3.5%	18.3%	1.7%	71.3%
Equity levered	0.0%	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%	5.2%	5.2%	24.4%	4.4%	100.0%

Table 8: Consistency of nominal/real hurdle rates and cash flows.

The rows in this cross-tabulation show whether the firm uses a nominal or real hurdle rate, the columns indicate whether cash flows are calculated in nominal or real terms. The fractions denote the number of firms for each combination relative to the total of 123 respondents that responded to both separate survey questions.

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

Table 9: 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.

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

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

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

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

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

(vi) 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.

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

(viii) 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	Weighted average of (1) and (6)	Maximum of (1) to (7)
#	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean	0.93	0.94	0.73	0.69	0.94	0.94	1.01	1.27
Median	0.83	0.88	0.62	0.64	0.87	0.91	0.91	1.14
Minimum	-0.27	0.16	-0.32	-0.09	-0.00	0.34	0.38	0.41
Maximum	3.12	2.39	2.14	2.16	3.14	1.79	2.17	3.14
Std. dev.	0.72	0.47	0.50	0.47	0.56	0.35	0.40	0.59
25th quantile	0.42	0.61	0.45	0.34	0.63	0.68	0.72	0.87
75th quantile	1.18	1.11	1.01	0.95	1.19	1.12	1.26	1.59
Skewness	1.15	1.15	0.73	0.81	1.03	0.63	0.74	1.17
Kurtosis	4.30	4.30	3.57	3.45	4.96	2.58	2.90	4.22
N	92	92	93	93	93	94	92	94

Table 10: Pairwise correlations between different beta estimates.

The correlation matrix shows the pairwise correlation coefficients for beta estimates using historical market data (1)-(7), and the maximum of all methods for each firm (8). The details of the beta estimations are described in the caption of Table 9. The number of observations varies from 92 to 94, depending on whether estimates using monthly data (92), weekly data, daily data (93), or industry averages (94) are used.

Method	Monthly	Adjusted	Weekly	Daily	Sum beta	Industry	Weighted	Max.
#	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Monthly	1.00							
Adjusted	1.00	1.00						
Weekly	0.60	0.60	1.00					
Daily	0.62	0.62	0.90	1.00				
Sum	0.72	0.72	0.82	0.81	1.00			
SIC	0.36	0.36	0.25	0.30	0.33	1.00		
Weighted	0.72	0.72	0.48	0.52	0.57	0.85	1.00	
Max.	0.89	0.89	0.64	0.64	0.75	0.61	0.88	1.00

Table 11: Summary statistics for rates on senior, long-term debt and tax rates.

We report summary statistics for the 88 self-reported rates on senior long-term debt together with the 9 firms for which we infer the rate using the Z-score. For Z-scores of three and above we use the 10-year Treasury rate of 4.3% in October 2003 plus 1%; for Z-scores between 1.81 and 3, we assign a rate of T-bond rate plus 2.5%; and for firms with a Z-score below 1.81 the long-term bond rate is set to T-bond rate plus 4%. Self-reported rates below the 10-year Treasury rate of 4.3% are corrected to 4.8%. Tax rates are computed as total income taxes divided by income before taxes. In case on of the input variables is negative we assign a tax rate of zero. Tax rates are also capped at 34%.

	Long-term debt	Tax rate
Mean	6.30	0.19
Median	6.00	0.27
Minimum	4.80	0.00
Maximum	12.50	0.34
Std. dev.	1.65	0.16
25th quantile	5.00	0.00
75th quantile	7.00	0.34
N	97	100

Table 12: Summary statistics for weighted average cost of capital (WACC).

The table shows summary statistics for the weighted average cost of capital (WACC) for the sample firms where we can match with Compustat data. In calculating cost of equity from the Capital Asset Pricing Model (CAPM) we compare the results when using seven different methods to estimate beta coefficients. The specific regressions we run are detailed in the caption of Table 9. The last column, method (8) provides the results when we use for each individual firm the maximum beta from methods (1) to (7).

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	Weighted average of (1) and (6)	Maximum of (1) to (7)
#	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean	9.32	9.44	8.66	8.42	9.57	9.54	9.87	11.25
Median	8.16	8.51	8.23	8.33	8.87	9.15	9.22	10.04
Minimum	2.68	5.09	4.10	4.56	4.26	5.23	5.67	5.69
Maximum	21.98	17.99	16.67	16.46	19.97	15.56	15.55	21.98
Std. dev.	4.08	2.82	2.65	2.63	3.07	2.38	2.52	3.59
25th quantile	6.78	7.52	6.88	6.42	7.69	7.86	7.84	8.57
75th quantile	10.82	10.48	9.76	9.48	11.74	10.61	11.80	13.21
Skewness	1.22	1.21	1.01	0.86	0.84	0.71	0.67	1.09
Kurtosis	4.33	4.14	3.98	3.47	3.74	2.77	2.54	3.63
Mean	83	83	84	84	84	85	83	85

Table 13: Summary statistics for hurdle premium = hurdle rate – weighted average cost of capital (WACC).

We define the hurdle premium as the difference between the self-reported hurdle rate and the weighted average cost of capital (WACC). The table reports summary statistics for the cross-section of firms that revealed their identity and are publicly traded such that we can match the corresponding returns on equity from CRSP and calculate WACC. Knowing the identity of these firms we infer the WACC using the Capital Asset Pricing Model (CAPM) to estimate the cost of equity. For details on these beta coefficients see the caption of Table 9. The parameters used for the CAPM are 4.3% for the risk-free rate (the rate for 10-year Treasury bonds at the time of the survey at the end of October 2003) and a historical equity premium of 6.6% (the average excess return of the large stocks over long-term bonds from January 1926 to December 2003). The table shows the results for different approaches to estimate the beta coefficient. The last column tabulates the statistics when for each individual firm the maximum beta estimates from the methods (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	Weighted average of (1) and (6)	Maximum of (1) to (7)
#	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean	5.24	5.15	5.94	6.03	5.09	4.99	4.68	3.30
Median	5.23	5.21	5.26	5.64	4.48	4.50	4.90	3.62
Minimum	-6.98	-2.99	-2.40	-0.85	-1.96	-5.56	-5.48	-6.98
Maximum	21.06	23.89	29.76	29.52	26.26	29.34	26.92	21.06
Std. dev.	4.89	4.48	4.94	4.86	4.66	5.22	4.95	4.70
25th quantile	2.46	2.05	3.01	3.07	1.71	2.01	1.21	0.62
75th quantile	8.04	7.32	7.87	7.55	6.76	7.43	7.17	5.37
Skewness	0.27	1.09	1.88	1.87	1.66	1.39	1.19	0.50
Kurtosis	4.29	6.22	9.36	9.41	7.77	8.21	7.37	4.90
N	70	70	71	71	71	72	70	72

Table 14: Bivariate regressions of hurdle rate, WACC, and hurdle premium on selected financial variables.

We run the following regression with the self-reported hurdle rate (columns 2-4), WACC (columns 5-7), or the hurdle premium (columns 8-10) as the dependent variable y_i . The hurdle premium is defined as the self-reported hurdle rate minus WACC.

$$y_i = a + b_1 \,(\text{Financial Variable})_i + e_i$$

Thus, the first column shows the set of explanatory variables we use for these bivariate regressions. The table shows the resulting estimated coefficients a and b_1 along with the *t*-statistics in brackets, and the R-squares.

Financial variable	Hurdle rate			WACC			Hurdle premium		
	Constant	Coeff.	R^2	Constant	Coeff.	R^2	Constant	Coeff.	R^2
WACC	9.81	0.52	0.18	.	.	.	.	.	.
	(7.03)	(3.81)	.	.	.	.	.	.	.
Beta	12.75	2.14	0.09	4.76	4.99	0.79	.	.	.
	(13.85)	(2.66)	.	(14.50)	(18.01)	.	.	.	.
Standard deviation	11.34	0.06	0.13	4.29	0.09	0.49	.	.	.
	(10.13)	(3.38)	.	(6.63)	(9.10)	.	.	.	.
Systematic risk	12.73	0.13	0.09	4.73	0.29	0.79	.	.	.
	(13.83)	(2.69)	.	(14.52)	(18.24)	.	.	.	.
Unsystematic risk	12.36	0.06	0.09	6.50	0.07	0.19	5.87	-0.02	0.01
	(11.64)	(2.59)	.	(8.59)	(4.55)	.	(5.22)	(-0.65)	.
Ln(total assets)	14.53	-0.03	0.00	11.26	-0.28	0.02	5.49	-0.04	0.00
	(8.48)	(-0.13)	.	(8.32)	(-1.42)	.	(2.91)	(-0.14)	.
Ln(sales)	16.04	-0.28	0.02	12.12	-0.45	0.06	6.46	-0.20	0.01
	(11.78)	(-1.29)	.	(9.83)	(-2.31)	.	(3.72)	(-0.74)	.
Debt/assets	15.42	-5.02	0.06	9.99	-2.62	0.02	5.95	-3.33	0.03
	(21.11)	(-2.25)	.	(16.85)	(-1.35)	.	(7.59)	(-1.34)	.
Current ratio	10.76	1.42	0.27	7.81	0.74	0.10	2.99	0.83	0.10
	(13.84)	(5.30)	.	(10.90)	(2.96)	.	(3.33)	(2.74)	.
Market/book ratio	14.45	-0.06	0.00	7.84	0.95	0.09	5.22	0.01	0.00
	(22.23)	(-0.42)	.	(11.23)	(2.88)	.	(5.51)	(0.03)	.
Firm changed its WACC	14.98	-1.68	0.03	9.67	-0.53	0.00	5.29	-0.05	0.00
	(20.61)	(-1.69)	.	(15.63)	(-0.59)	.	(6.02)	(-0.04)	.
Coefficient of variation of	14.85	-0.13	0.01	11.25	-0.49	0.19	4.57	0.18	0.02
EBITDA	(19.24)	(-0.87)	.	(19.83)	(-4.43)	.	(5.37)	(1.09)	.

Capital constrained	14.12	-0.00	0.00	9.54	0.51	0.03	5.26	-0.03	0.00
	(28.28)	(-0.01)	.	(21.76)	(1.70)	.	(8.69)	(-0.08)	.
Z-score	13.19	0.27	0.03	10.04	-0.18	0.02	3.91	0.28	0.03
	(17.47)	(1.51)	.	(16.51)	(-1.30)	.	(4.33)	(1.31)	.
Managerially constrained	14.10	0.03	0.00	9.30	0.39	0.01	5.21	0.20	0.00
	(26.49)	(0.07)	.	(20.04)	(1.08)	.	(8.44)	(0.40)	.
Adjusts for risk in	13.66	3.15	0.09	9.74	-0.69	0.01	3.93	3.57	0.11
hurdle rates	(14.03)	(2.21)	.	(12.00)	(-0.61)	.	(3.42)	(2.20)	.
Adjust for optimistic	14.41	-0.58	0.00	10.00	-1.40	0.03	5.11	0.39	0.00
cash flows	(22.62)	(-0.56)	.	(17.68)	(-1.52)	.	(6.64)	(0.32)	.

Table 15: Relationship Between Systematic Risk, Unsystematic Risk and Hurdle Rates

The table summarizes the results from regressions of the hurdle rate, the weighted average cost of capital (WACC), cost of equity levered and the hurdle premium (defined as the difference between hurdle rate and WACC) against systematic risk, unsystematic risk, and both. Thus for each dependent variable we tabulate the results from three regressions. The cells contain the estimated coefficients with the *t*-statistics below, and the R-squares of the regressions. In this table the explanatory variables are arranged in the columns.

$$y_i = a + b_1(\beta_i \sigma_m) + b_2(\sigma_i - \beta_i \sigma_m) + \varepsilon_i$$

	a constant	b_1 systematic risk	b_2 unsystematic risk	R^2
Hurdle rate	12.73	0.13	.	0.09
	(13.83)	(2.69)	.	.
Hurdle rate	12.36	.	0.06	0.09
	(11.64)	.	(2.59)	.
Hurdle rate	11.40	0.10	0.04	0.13
	(9.97)	(2.02)	(1.89)	.
WACC	4.73	0.29	.	0.79
	(14.52)	(18.24)	.	.
WACC	6.50	.	0.07	0.19
	(8.59)	.	(4.55)	.
WACC	4.05	0.28	0.02	0.81
	(10.24)	(16.73)	(2.82)	.
Levered cost of equity	4.28	0.39	.	1.00
	(239.93)	(433.75)	.	.
Levered cost of equity	7.66	.	0.07	0.12
	(8.49)	.	(3.56)	.
Levered cost of equity	4.29	0.39	-0.00	1.00
	(188.96)	(405.39)	(-0.83)	.
Hurdle premium	7.98	-0.17	.	0.17
	(8.83)	(-3.76)	.	.
Hurdle premium	5.87	.	-0.02	0.01
	(5.22)	.	(-0.65)	.
Hurdle premium	7.65	-0.18	0.01	0.18
	(6.72)	(-3.70)	(0.48)	.

Table 16: Potential explanations for the hurdle premium.

To what extent do these statements agree with your company's views?	% strongly agree	Mean	N	Strongly disagree -2 -1 0 1 2 Strongly agree
a) We need a higher hurdle rate to account for optimism in cash flow forecasts.	9.0%	0.03	122	
b) There are some good projects we cannot take due to limited access to capital markets.	16.8%	-0.04	125	
c) We cannot take all profitable projects due to limited resources in the form of limited qualified management and manpower.	16.0%	0.47	125	
d) We invest more in projects in years when the firm has more operating cash flows.	17.6%	0.30	125	

Table 17: Advantages of debt and equity, and the choice of the optimal debt/equity mix.

	% strongly agree	Mean	N	Strongly disagree -2 -1 0 1 2 Strongly agree
1. The advantage of debt for your firm is that				
a) interest payments are tax-deductible.	27.3%	0.69	121	
b) it forces the firm to be more efficient.	7.8%	-0.23	115	
c) it is a cheaper source of funds even if the interest payments were not tax-deductible.	21.2%	0.54	118	
d) it provides substantial flexibility.	15.3%	0.30	118	
2. The advantage of equity is that				
a) it increases the firm's flexibility.	29.1%	0.68	117	
b) it reduces costs of financial distress.	18.6%	0.61	118	
c) it does not obligate the firm to make payments to shareholders.	15.4%	0.12	117	
3. What factors determine the optimal debt/equity mix of your firm?				
a) We borrow to the extent that the marginal interest tax shield becomes zero.	0.1%	-0.89	118	
b) We do not borrow at all so the firm will not operate in financially distressed situations.	6.7%	-0.92	119	
c) We borrow until the tax advantage becomes equal to the financial distress disadvantages of debt	5.9%	-0.36	118	
d) 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.	29.2%	0.83	120	
4. We would borrow more if				
a) we had more taxable income.	14.4%	-0.16	118	
b) we had more tangible assets.	9.1%	-0.48	121	
c) we were in a higher tax bracket.	1.8%	-0.87	116	

Figure 1: Company characteristics.

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

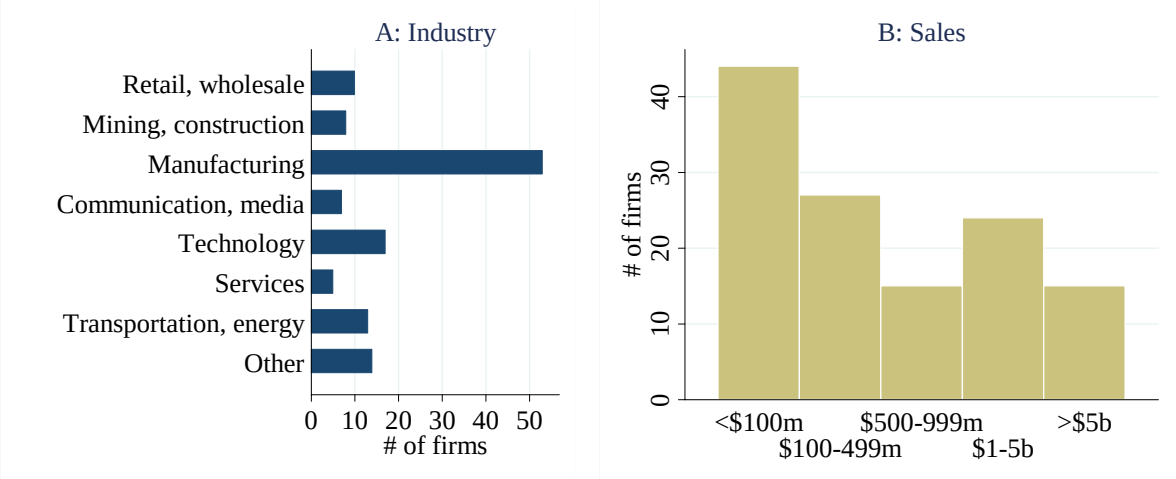


Figure 2: Capital budgeting methods.

The bar chart illustrates the ranking of the two preferred capital budgeting methods. For the eleven respondents that do not provide a ranking, a rank of one is assigned to all methods checked. Therefore, the total of first choices, 141, exceeds the number of 121 respondents to this question. The number of second choices is substantially lower as some firms mainly rely on a single technique.

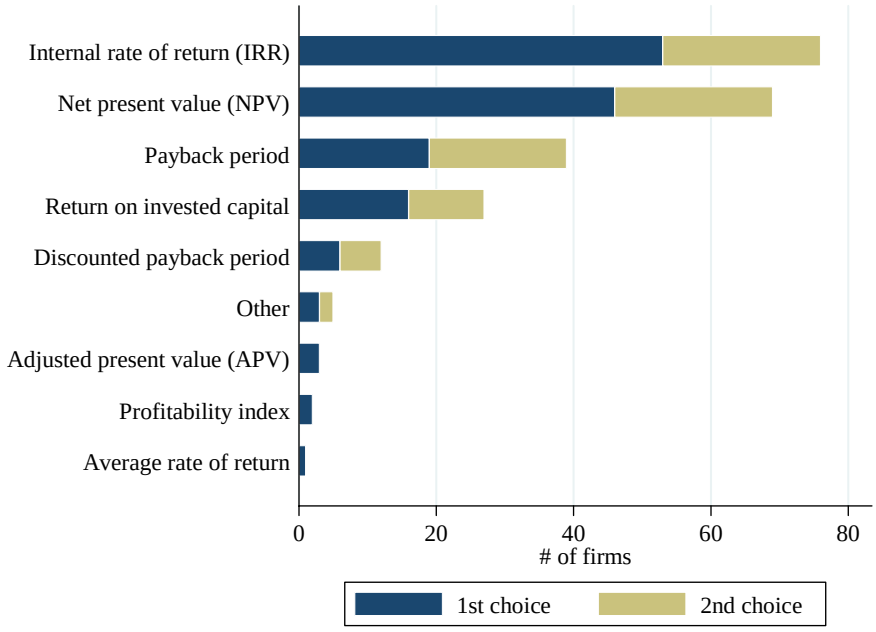


Figure 3: Adoption of DCF methods, WACC, CAPM, and company-wide hurdle rates.

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

(i) use discounted cash flow (DCF) methods, that includes 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 hurdle rate when making capital budgeting decisions.

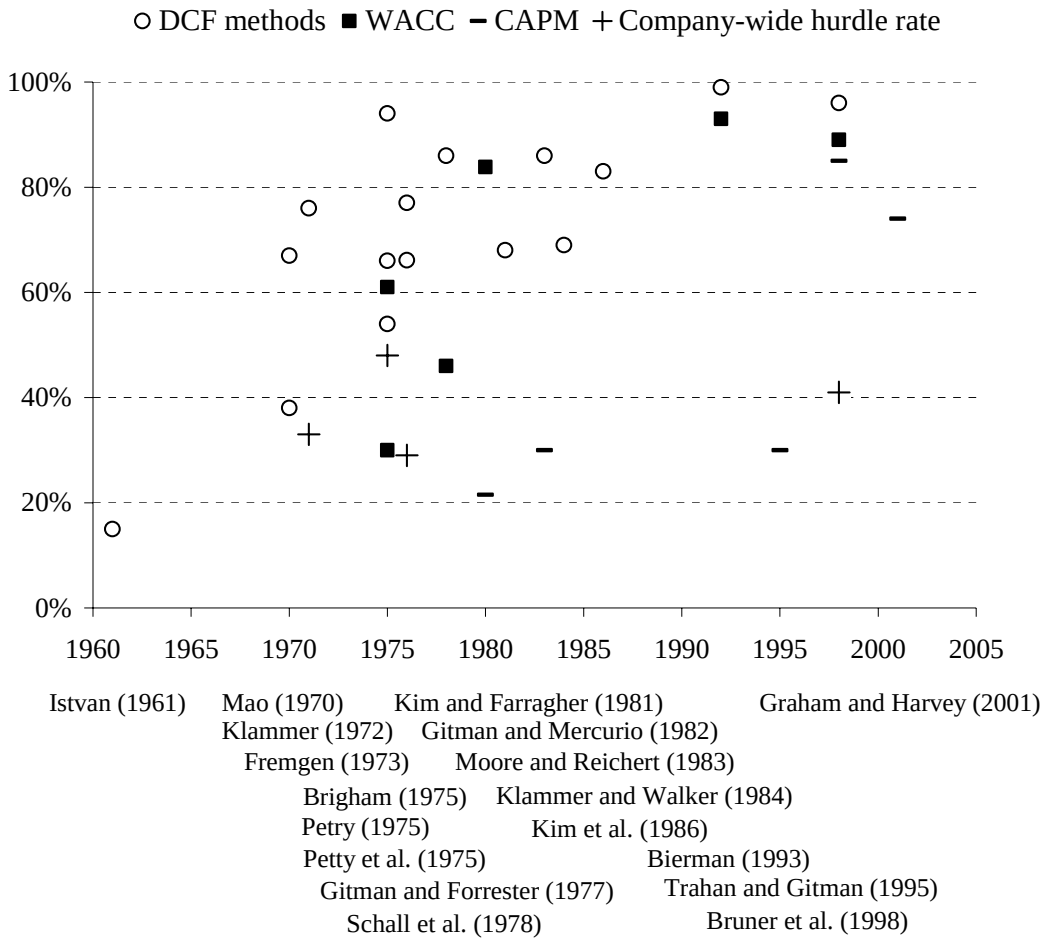


Figure 4: What the hurdle rate represents.

A total of 117 firms responded to this question. The eleven firms that indicate that they add a premium to weighted average cost of capital (WACC) as their hurdle rate are included in the category WACC.

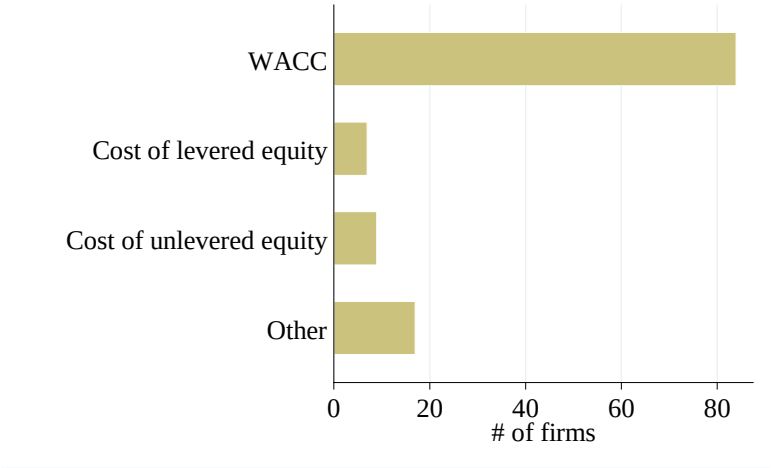


Figure 5: Hurdle rates.

The histogram plots the nominal hurdle rates that the firms have used for a typical project during the last two years.

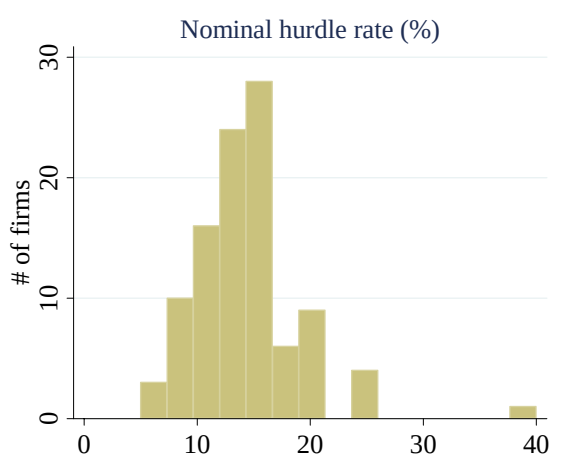


Figure 6: Hurdle premium using beta from 5-year monthly data.

The hurdle premium is defined as the difference between the self-reported hurdle rate and the weighted average cost of capital (WACC) we compute from CRSP and Compustat. We use the Capital Asset Pricing Model (CAPM) to infer the cost of equity. The parameters we use are 4.3% for the risk-free rate (10-year Treasury bond rate in October 2003) and an equity premium of 6.6% (return on large stocks minus the return on long-term government bonds from 1926-2003). Beta coefficients are inferred from a regression of monthly returns for the firm on returns on the S&P 500.

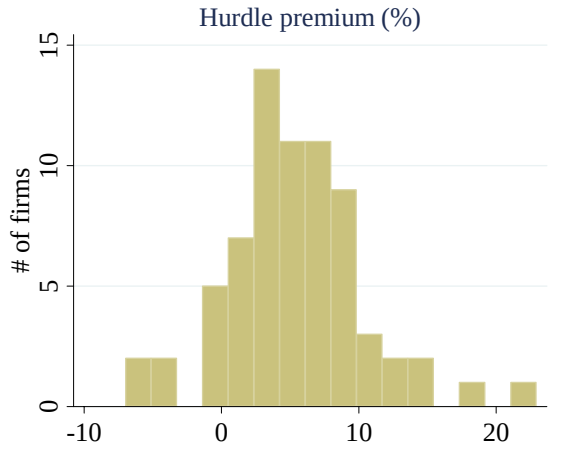


Figure 7: Pecking order.

The bar chart illustrates the responses of 114 CFOs to the question: "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 firs 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.)" The bars display the mean of the ranks that the respondents assigned to the different financing sources.

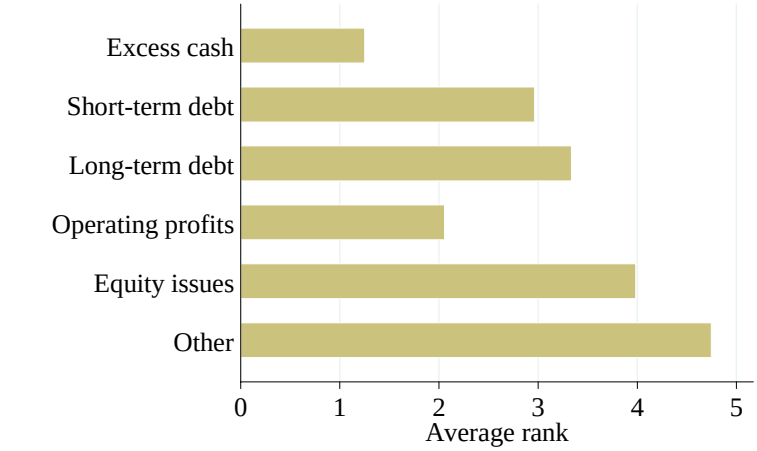


Figure A.1 Additional firm characteristics

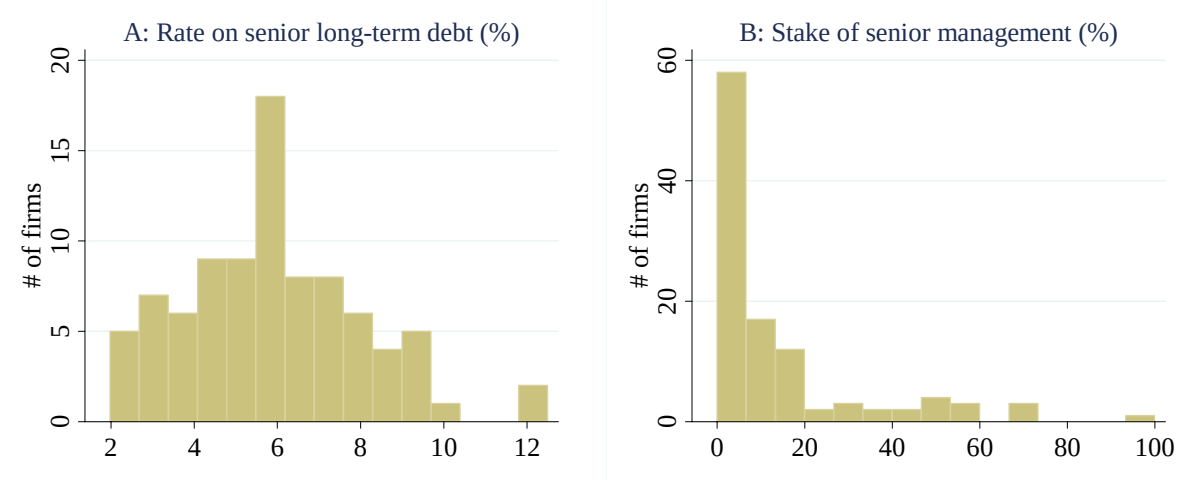


Figure A.2: CFO Profiles