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Determinants of capital budgeting methods and hurdle rates in Nordic firms

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ABSTRACT

We study the determinants for the choice of capital budgeting methods and the setting of hurdle rates (WACCs) in five Nordic countries. Combining survey data with a rich set of determinants, including ownership data, CFO characteristics, and financial data, we find that the use of the Net Present Value method and the sophistication of the capital budgeting are related to firm characteristics, variables proxying for real option features in investments and CFO characteristics (age and education). We also find support for significantly higher hurdle rates than motivated by economic theory. The premium is weakly positively related to managerial short-term pressure and strongly negatively related to the sophistication level of the firm's capital budgeting.

Key words: Capital budgeting methods; Hurdle rate; Weighted average cost of capital; Net Present Value; Internal Rate of Return; Nordic countries

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1 INTRODUCTION

Since the early surveys (e.g. Klammer, 1972; Brigham, 1975) of capital budgeting methods used in firms, discounted cash flow (DCF)-based methods, such as the Internal Rate of Return (IRR) and, especially, the Net Present Value (NPV) rule, have increasingly gained ground as the main methods for evaluating investment decisions.¹ Despite some doubts concerning the universal suitability of the NPV,² it is generally considered superior to the payback method and the IRR. However, several puzzling empirical findings concerning capital budgeting methods and the setting of discount rates remain. These include the widespread use of ‘unsophisticated’ investment evaluation methods as well as the hurdle rate premium puzzle: the hurdle rates used typically seem too high compared to rates suggested by financial theory.

Our study addresses the above-mentioned puzzles, for which there may be both theory based as well as behavioural reasons. Our specific aim is to test for the determinants of the capital budgeting methods chosen and the hurdle rate premium. We use econometric methods suitable for the problem, such as ordered probit models. We contrast explanatory variables based on financial theory (related to agency problems, and investment decision-making when the project includes real options) with others based on behavioural elements such as the age and education of the respondent. We also produce an index for the ‘sophistication’ level of the capital budgeting methods used and test for the determinants of such sophistication. Our data on capital budgeting methods are based on a survey of listed firms in the five Nordic countries (Denmark, Finland, Iceland, Norway and Sweden). Combining survey responses with firm-level financials, ownership data and data on respondent characteristics (age and education) enables us to use a set of explanatory variables more extensive than in previous studies.

We find that the use of the NPV method as a primary method and the sophistication of the firm’s capital budgeting are linked both to firm characteristics

¹ In most US studies, NPV and IRR are typically the most common methods, and often reported to be used by more than 90 per cent of the companies (see e.g. Graham and Harvey, 2002). In Europe, on the other hand, the payback method has still been the most common method (Brounen et al., 2004). For the Nordic markets, see, for example, Holmén and Pramborg (2006) for Sweden, and Liljebloom and Vaihekoski (2004) for Finland.

² The appropriateness has been questioned, for example, due to agency problems within the firm, the way in which WACC is implemented, or disequilibrium-related non-additivity (c.f. Berkovitch and Israel, 2004; Miller, 2009; Pierru, 2009; Magni, 2008).

(size) and variables proxying for real option features in the firm's investment projects and also to CFO (Chief Financial Officer) characteristics (age and education). For the hurdle rate, we find, in line with Meier and Tarhan (2007), a significant positive hurdle rate premium. The sophistication of the capital budgeting in the firm is a strong determinant of the hurdle rate premium. We also find weak support for a positive relationship between managerial short-termism³ and the hurdle rate premium. These results are broadly in line with two classes of explanations: predictions about investments that have real options characteristics, and agency cost related predictions, because both combine the use of higher hurdle rates with a higher use of multiple methods and 'rules of thumb'.

Several puzzling empirical findings concerning capital budgeting methods and the setting of discount rates for projects have motivated our study. First, a high number of firms still use unsophisticated capital investment evaluation methods. Different reasons for the lack of sophisticated investment evaluation methods as well as the common use of 'rules of thumb' in capital budgeting have been suggested, for example, by Poterba and Summers (1995), Jagannathan and Meier (2002), Berkovitch and Israel (2004), McDonald (2006), Holmén and Pramborg (2006), and Magni (2008). These include curbing managerial over-optimism and agency problems related to project approval, limited managerial and organisational capital, implicit inclusion of elements from real option valuation, and taking into account political risk and bounded rationality. Other papers relate the education of the CFO to the use of more sophisticated capital budgeting methods, as in Graham and Harvey (2002) and Meier and Tarhan (2007), or estimate binary models explaining choices of capital budgeting methods, as in Brounen et al. (2004) and Hermes et al. (2007). However, few studies look into cross-sectional determinants of the choices of capital budgeting methods in a broader context.⁴

³ By managerial short-termism we mean pressure, felt by the manager, to produce a good result in the short-term even if it contrasts with the firm's long-term goals. This is a variable collected through a questionnaire.

⁴ In addition to control variables (size, industry), Hermes et al. (2007) focus largely on country effects and CFO characteristics in their estimation models for the determinants of capital budgeting methods. Brounen et al. (2004) estimate multivariate probit models to study four aspects: the use of DCF methods, whether cost of capital is computed and the CAPM used, and whether more sophisticated discount rates for investment projects are applied. They use data for four European countries: the UK, the Netherlands, Germany, and France. However, both studies use a rather limited set of explanatory variables. We contribute by a richer set of explanatory variables based on firm and ownership characteristics and by testing more directly different hypotheses concerning the determinants of the sophistication of capital budgeting methods. Our paper is also the first comprehensive study of capital budgeting in all of the Nordic countries,

Second, survey results indicate that firms often do not take project-specific risk fully into account; they often use a single discount rate for all projects and adjust it less frequently over time.⁵ Furthermore, when asked to report an average nominal (or real) discount rate used for projects, the number has often appeared to be substantially higher than justified by corporate finance theory.⁶ However, only a few papers have explicitly studied the determinants of reported hurdle rates in the US (e.g. Poterba and Summers, 1995; Meier and Tarhan, 2007). In particular, Meier and Tarhan (2007) analyse in more detail this ‘hurdle rate premium puzzle’ and indeed find that reported rates appear to be much too high compared to reasonable rates obtained using empirical inputs for debt and equity, the CAPM for the calculation of the return on equity, and taking firm leverage into account.⁷

By providing a comprehensive analysis of the drivers of the development of capital budgeting methods as well as the setting of hurdle rates, we address both of the puzzles discussed above. We contrast variables from two main categories of explanations: (i) explanatory variables that explain why certain methods used may be preferable to others, given agency problems within the firm (the agency problems are expectedly larger in larger, often more complex or diversified firms, and in firms not closely controlled by the main owner) and option-like features in the firm’s projects; and (ii) explanatory variables that relate to either external pressure (short-term pressure from

and we study only listed firms, which gives a better comparison to many studies mixing listed or large (Fortune 500) firms.

⁵ Klammer (1972) reports that only 39 per cent of the firms used some specific formal method to adjust for risk (with 21 per cent adjusting the rate of return). In Gitman and Forrester (1977), 29 per cent did not give explicit consideration to risk. The most popular technique was to adjust the rate of return (42.7 per cent). In Gitman and Mercurio (1982), 33.3 per cent did not differentiate between project risk and when they did, adjusting cash flows was slightly more common than adjusting the discount rate. Poterba and Summers (1995) report opposite findings, as most firms in their sample used more than one hurdle rate, and a lower one for strategic projects. In Graham and Harvey (2001), the dominant answer (with responses between 51.3 and 88.9 per cent) to the question of whether the firm should adjust either cash flows or the discount rate to risk factors was ‘neither’. Moreover, most firms (58.8 per cent) would always or almost always use a single, company-wide discount rate for overseas projects. In Liljebloom and Vaihekoski (2004) for Finland, 45.5 per cent used the same discount rate as for the whole company (WACC), 60 per cent answered that the discount rate is changed only approximately once a year, and 25 per cent answered that it does not change every year. In Meier and Tarhan (2007), 52.5 per cent of the firms in their sample reported that they did not change their hurdle rates during the 3 years preceding the survey date.

⁶ Examples of average discount rates reported are: mostly (in 57 per cent of the cases) between 10 and 15 per cent in Gitman and Forrester (1977); 14.3 per cent in Gitman and Mercurio (1982); a real rate of 12.2 per cent in Poterba and Summers (1995); a nominal rate of 12.2 per cent in Sandahl and Sjögren (2003) for Sweden; a mostly nominal rate of 15.2 per cent in Liljebloom and Vaihekoski (2004); and a real hurdle rate of 11.6 per cent in Meier and Tarhan (2007).

⁷ The puzzling observation of surprisingly high reported discount rates during more recent periods of low inflation has also been discussed, for example, in Poterba and Summers (1995), and Liljebloom and Vaihekoski (2004).

shareholders or stakeholders) or internal behavioural characteristics (CFO age and education). This is a rich set of characteristics, never before combined in this manner to study the determinants of capital budgeting methods.

The remainder of this paper proceeds as follows. The potential factors influencing the choice of capital budgeting methods and the hurdle rate are presented in the second section. The survey method and our background data are presented in Section 3, while we describe our variables in Section 4. In Section 5, we present the responses from the surveys, while the actual testing of the determinants of capital budgeting methods and the hurdle rate is presented in Section 6. The final section offers conclusions and some suggestions for further research.

2 FACTORS INFLUENCING CAPITAL BUDGETING

Meier and Tarhan (2007) summarise the typical primary findings from prior surveys as follows: (i) over time, firms show an increasing tendency to use DCF-based methods; (ii) firms mostly use weighted average cost of capital (WACC) as the discount rate; and (iii) when computing the discount rate, the cost of equity is typically inferred from the CAPM. They also compare prior surveys and find an increasing usage of these methods over time. These findings suggest increasing sophistication of capital budgeting over time. However, such a development may not be quite straightforward. Using 'rules of thumb,' multiple methods, aside from the NPV, and hurdle rates that appear too high may be suitable for other reasons. In the following, we provide a brief survey of such 'near-rational' suggested reasons for either the use of less 'sophisticated' methods or hurdle rates higher than the cost of capital.

2.1 Real options

Jagannathan and Meier (2002) show that a hurdle rate higher than the cost of capital (a hurdle premium) may capture the option value and that, given the uncertainty associated with the cost of capital, managers may choose a single, sufficiently high hurdle rate that is near optimal for a range of costs of capital. They predict that a higher hurdle premium would be more likely for projects that require the use of skilled manpower or special purpose facilities that take time to build, face organisational constraints, and lock in much of the capacity of the firm. Because such capacity is not easy to replace, they would prevent the firm from taking other similar projects (which might be even better) in the near future. In this case, there can more clearly than for other projects be an option to wait value included. For such projects, the hurdle rate used might be higher, independent of the project's systematic risk. That is, firms with complex projects would have a hurdle rate premium. Also, for example, Jagannathan et al. (2011) link the hurdle rate premium to real options, arguing that it depends on the option to defer investments, and find that growth firms use a higher hurdle rate than value firms. Concerning the capital budgeting method, McDonald (2006) suggests that the simultaneous use of many capital budgeting methods parallel to DCF, such as IRR, payback, and P/E multiples, may mean that managers perform a variety of formal calculations and then make decisions by weighing the results and using subjective judgment. A part of such judgment may represent their 'adjustments' of DCF methods to take into account real option values.

Hypothesis 1: We expect that firms with more real options may use higher hurdle rates and rely on also other capital budgeting methods than the NPV.

2.2 Agency problems

Poterba and Summers (1995) suggest that managers may set hurdle rates above the required returns to correct for overly optimistic cash flow projections for projects they are asked to consider. For project managers, suggesting the projects for top managers, to want to push their projects in such a way, there must be some reward for getting a project approved. Berkovitch and Israel (2004) analyse a case where the headquarters of a divisionally organised firm simultaneously set-up capital budgeting criteria and management compensation systems under asymmetric information and agency problems. Whereas the NPV rule would maximise firm value under perfect observability, they show that when the headquarters only can observe projects brought to them, and when there are agency problems with divisional managers (who want to maximise project size rather than firm value), the NPV rule on the headquarter level does not work well (it cannot be modified in a way which would implement the best outcome in project selection, as long as divisional managers choose which projects to bring forward). However, IRR and the profitability index can be adjusted in a way which leads to optimal implementation. Based on these results, Berkovitch and Israel (2004) suggest that firms may use modified versions of budgeting criteria, such as a hurdle rate different from the cost of capital; for example, large multinational firms with implementation problems can use a hurdle rate with a fudge factor added to the cost of capital.

Martin (2008) suggests that also the use of a single discount rate, instead of project-specific rates, may have its roots in managerial incentives to obtain projects that offer personal benefits if approved. Such incentives may encourage managers to inflate the expected cash flows and understate project risks. While systematic inflation of cash flows is relatively easy to detect ex-post, it is harder to determine whether the discount rate applied was appropriate. To address this problem, a firm may restrict the use of discount rates to a single one. Martin (2008) suggests that larger and more bureaucratic firms with multiple levels of management might be more subject to such incentive problems compared to smaller owner-run firms.

Hypothesis 2: We expect that firms with higher agency problems will use higher hurdle rates and more often other capital budgeting methods than the NPV.

2.3 Political risk

Holmén and Pramborg (2006) suggest that because political risk may be nonlinear and involves qualitative judgment, a firm may tend to use a rule of thumb such as the payback method. They report that in their sample of Swedish firms, the use of NPV decreases with the political risk of the host country and the use of the payback method increases.

Hypothesis 3: We expect that a higher political/country risk will be associated with higher hurdle rates and less sophisticated capital budgeting methods.

2.4 CEO/CFO characteristics

Manager qualifications, such as the level of knowledge of capital budgeting methods, may also matter. Graham and Harvey (2002) find that CEOs with MBAs are more likely than non-MBA CEOs to use NPV. Furthermore, Brounen et al. (2004) and Hermes et al. (2007, for firms in China) find that a CFO's education (as well as age, in Hermes et al., 2007) is a significant determinant for whether the firm uses NPV.

Hypothesis 4: We expect that older and less educated managers will prefer less sophisticated capital budgeting methods.

2.5 Short-term pressure

Recently, several studies (e.g. Graham et al., 2006) have reported evidence of value-destroying actions and/or myopic management decisions. If the managers feel pressure to produce improved results above all in the short-term, even actions that hurt long-term performance may be undertaken. Liljeblom and Vaihekoski (2009) studied effects of such short-term pressure. Using ownership data on companies' main owner, they grouped firms into potentially more long-term-oriented (privately owned firms, co-operatives and firms owned by the state or a municipality) versus short-term-oriented firms (listed firms, firms owned by an activist owner, a foreign owner, or another company).⁸ If owner preferences influence firms' investment decisions, firms controlled by owners with a shorter horizon may prefer projects producing cash-flows

⁸ The grouping of firms was based on the growing literature on the differences between owner types, where, for example, the ownership duration has been studied, and owners with different trading strategies and portfolio turnover have been identified. For example, mutual funds have been pointed out as an owner type which has an increasingly short investment horizon and such owners are often among the dominating ones in large listed firms.

in the near future. Such preferences may lead to the use of hurdle rates higher than the cost of capital, because such rates favour projects which produce returns in the near future (i.e. increasing the hurdle rate punishes in relative terms more the present values of the cash-flows from long-term projects, as compared to projects paying back soon). Liljeblom and Vaihekoski (2009) found support for many significant differences between firms with different types of owners, for example, that reported WACCs were significantly higher (17.1 per cent versus 12.8 per cent) among firms grouped as potentially more short-term-oriented.

A classical and simple method to require fast results is to require a short pay-back period (in the international finance literature, use of pay-back is suggested to control for political risk). Thus, as suggested by, for example, Thakor (1990) in the connection with capital rationing, a preference towards short-term projects may, for example, be implemented by the use of the payback method.

Hypothesis 5: We expect that firms subject to higher short-term pressure will use higher hurdle rates and other capital budgeting methods (the payback method) instead of the NPV.

We will use explanatory variables related to the categories above to explain the choice of capital budgeting methods and hurdle rates. In general form, our models are:

$$\text{CapBudg} = f(\text{agency costs, real options, country risk, behavioural, controls}), \text{ and} \quad (1)$$

$$\text{Hurdle rate premium} = f(\text{agency costs, real options, country risk, behavioural, controls}), \quad (2)$$

where CapBudg is a variable for the sophistication of the capital budgeting method, such as the use of NPV, or an index capturing several items related to the sophistication of the capital budgeting method. The first three vectors of explanatory variables suggest that cross-sectional differences between firms can exist even if, in general, they use rather 'sophisticated' methods, because it may be 'near-optimal' to use an alternative method to capture real option value, political/country risk, or to cope with agency problems. The fourth vector suggests that behavioural aspects, such as the manager's level of education, or short-term pressure influence capital budgeting and

hurdle rate setting. The actual variables used to proxy for these hypothetical explanations will be discussed in Section 4.

3 THE SURVEY AND BACKGROUND DATA

3.1 The survey

We use responses from a questionnaire directed to all CFOs of listed firms with corporate headquarters in a Nordic country (Denmark, Finland, Iceland, Norway, and Sweden). The questionnaire included questions (available from the authors) regarding⁹ the capital budgeting methods used in the firm. The survey was conducted in two stages. First, the questionnaire was in early December, 2007, sent to the Nordic firms listed on the exchanges operated by the OMX (now NASDAQ OMX), that is, firms in Denmark, Finland, Iceland, and Sweden. In the second stage, in May, 2008, the questionnaire was sent to the respondents at the firms listed on the Oslo Børs in Norway. The questionnaire was sent as a letter directed to a named, manually collected respondent. Because out of a total of 780 firms, in the case of 69 firms we were unable to find a specific CFO, the total number of questionnaires sent was 711. We received 157 responses (a response rate of 22.1 per cent). Most responses came from Sweden (71) and least from Iceland (6). The highest response rate was for the Iceland (33.3 per cent), followed by Sweden (28.3 per cent), Denmark (25.0 per cent), Finland (18.8 per cent) and Norway (12.9 per cent).

3.2 Background data

The responses were matched with firm financials and ownership data. The financial data is primarily from the Amadeus database, complemented by data from Datastream and annual company reports. The financials are from the last full reporting year prior to the survey, that is, mainly from the year-end 2006 for all but Norway, and from 2007 for Norway. Year-end exchange rates were used to convert all financials to Euros. Financial data were also collected for all listed Nordic firms receiving the questionnaire (the population).

A comparison of the descriptive statistics for our respondents (the sample) and the population show that the firms in our sample are larger than the firms in the population both in terms of turnover, the number of employees and total assets, especially when comparing only the financial firms in both groups. The likely reason to this is that the

⁹ We did not include foreign American depository receipts (ADRs) or 'off-shore' firms, i.e., firms with non-Nordic headquarters. This study is also part of a bigger project, where also CEOs and Chairmen of the Board obtained their sets of questions.

appearance of a named CFO may correlate with firm size. Our non-financial firms are also marginally less profitable (lower Return On Assets, ROA), while our financial firms are more profitable. However, using a t-test for groups with unequal variances, the differences in financials for the sample and population are never statistically significant.

4 VARIABLES

4.1 Our dependent variables

To study the determinants of capital budgeting methods and the hurdle rate, we estimate two types of models, using proxies for the potentially influential factors as explanatory variables. When studying the determinants of the capital budgeting method, we will, in line with Hermes et al. (2007), regress the responses concerning different main capital budgeting methods on potential determinants. Because NPV was used as the most common primary method (used so by 64 out of 155 respondents), and because the dispersion between the other methods is large, we focus on the use of the NPV. This will be measured by a binary variable, `NPV_as_primary`, taking the value of one if the firm has chosen NPV as one of the primary methods.

We also construct four measures for the degree of ‘sophistication’ of the capital budgeting method and study determinants of them. Our indexes are original to this paper and only intended as proxies. However, they are related to financial theory in the sense that higher values of the indexes indicate a use of the capital budgeting tools in line with the recommendations in financial theory and text-books. They also are closely related to, for example, Hermes et al. (2007), who estimate separate multivariate logit models for a number of survey responses such as the capital budgeting method used, whether a project-specific cost of capital is used, and the WACC. Instead of analysing each in turn, we just add such binary responses from our survey into a single discrete variable, taking values over a wider range from zero upwards. Our indexes resemble the dependent variables in Holmén and Pramborg (2006), where the dependent variables range from, for example, 0 to 4, or)4 to +4, measuring the relative frequency of the use of, for example, the NPV¹⁰ and allowing for us the use of ordered probit models.

Our alternative indexes are formulated so that we add binary variables measuring either a less sophisticated use of a capital budgeting technique (in which case a zero value is addressed to the binary variable) or a more sophisticated one (when the binary

¹⁰ The construction of indexes for the measurement of management practices or country standards is widely used, see, for example, the construction of corporate governance indexes such as that of Gompers et al. (2003), the building up of indexes for various purposes in the law and finance literature such as for anti-director rights and creditor rights in La Porta et al. (1998), and various measures for the level of financial disclosure in the accounting literature, see, for example, Botosan (1997). In such indexes, typically many binary variables, each measuring either the existence of/lack of some procedure, are added to form a multivariate variable.

variable takes the value of one). Index_1 is the sum of three survey responses, for this purpose coded as binary variables. The first binary variable takes the value of one if DCF is used (in general) as one of the methods. The second (third) binary variable takes the value of one if DCF (NPV) is selected as one of the primary methods. The theoretical argument for these three variables is that DCF methods are in the financial literature recommended over more simple 'rules of thumb' and that out of the DCF methods, the NPV is viewed as the method which maximises firm value in a world without agency costs and other distortions (and without real options present). Because several methods could be chosen as a primary method, Index_1 ranges from zero to three.

Index_2 extends Index_1 by further adding one binary variable, which takes the value of 1 if the firm has indicated that it changes its WACC over time and is zero otherwise. Index_3 is the sum of Index_2 and one more binary variable, which takes the value of one if the firm uses different WACCs for different projects. Finally, Index_4 is the sum of Index_3 and a binary variable which takes the value of one if the firm uses different WACCs for projects otherwise identical but with different project lengths. Index_4 ranges between zero and six. The theoretical arguments for adding these three additional binomial variables are that WACCs can change over time and project if nominal interest rates, risk premiums and risks change, likewise projects of different length may have different WACCs if the nominal interest rates and risk premiums have a time structure. Index_4 ranges between zero and six.

In the model for the hurdle rate premium (model 2), the dependent variable is calculated as the difference between a WACC obtained as a survey response (WACC_survey) and a theoretical WACC calculated by us (WACC_theor). The survey variable was collected through the same survey as the responses to the capital evaluation methods and was the answer to a question concerning 'the required rate of return for the whole company (WACC)'.

The theoretical WACC was calculated using inputs for the return on equity and before-tax debt and corporate (flat) tax rates at the time of the survey in the Nordic countries. The returns on equity were calculated using the CAPM with firm-specific betas from regressing prior 1-year daily stock returns on daily local market returns, 10-year local-currency government bond yields as the risk-free rate, and an expected equity risk

premium of five per cent.¹¹ Ten-year local-currency government bond yields plus a hypothetical margin of one per cent were used as the return on debt. Because of lack of data on firm-specific costs of debt, we cannot unfortunately adjust the rate of return on debt for firm-specific differences in default risk.¹² At the time of the survey (prior to the financial crisis), corporate bond margins were rather narrow in the Nordic countries. Finally, we use market values of equity and book values of debt to calculate weights for equity and debt for the WACC formula.¹³ Thus, we implicitly assume, in line with Meier and Tarhan (2007), that the current capital structure is also the target capital structure.

4.2 The explanatory variables and hypotheses

Next, we will describe how we have created empirical proxy variables for the factors which may influence capital budgeting decisions.

4.2.1 Real options

According to hypothesis 1, we expect that firms with more real options may use higher hurdle rates and also other capital budgeting methods than the NPV. To proxy for the existence of real options, we use *Past_Growth* (change in sales between two past years).¹⁴ To capture potential momentum in growth options, we also include ROA, defined as net profit to total assets. As suggested by Jagannathan and Meier (2002), and Jagannathan et al. (2011), we expect that firms with more real options will use a higher hurdle rate. As McDonald (2006) suggests, we expect that firms with more real options will use a larger variety of methods, including ‘rules of thumb’. Although they also may use NPV with real options, the use of many methods may make them less likely to report the NPV method as their main one. We therefore expect negative signs

¹¹ Five per cent is a compromise in many ways. First, it is a common assumption for a long-run (arithmetic) equity premium. Second, it is close to the arithmetic average of the equity premiums reported by finance professors from four Nordic countries in the international survey by Fernandez and del Campo (2011). That survey reports as country averages 3.6 per cent for Denmark, five per cent for Finland, and 5.3 per cent for both Sweden and Norway. See also, for example, Meier and Tarhan (2007), who in their hurdle rate estimation use two alternatives for the equity premium, 6.6 per cent and 3.6 per cent.

¹² Bank debt is still a common form of financing in the Nordic countries, and thus, only a fraction of the firms in our sample might have issued traded bonds for which yield data might be obtainable.

¹³ One observation was lost due to the lack of input data for the weights in the theoretical WACC.

¹⁴ In line with Meier and Tarhan (2007), we also alternatively use the *Market_to_Book* value for the firm (market value of equity over book value of equity, from the last reporting year prior to the survey). The source of this variable is Datastream, complemented by manually collected data for the components in the variable. Our results (not reported here) are robust to this specification as far as the other variables are concerned, but *Market_to_Book* in itself has a lower explanatory power compared to *Past_Growth*.

for Past_Growth and ROA in the model for the capital budgeting method (model 1) and positive ones in the hurdle rate premium model (model 2).

4.2.2 Agency problems

According to our hypothesis 2, we expect that firms with higher agency problems will use higher hurdle rates and other capital budgeting methods than the NPV. Berkovitch and Israel (2004) and Martin (2008) suggest that larger and more bureaucratic firms/firms with multiple levels of management might be more subject to incentive problems influencing capital budgeting. We thus include the natural logarithm of sales as a size proxy. A problem with size is that larger firms typically use (e.g. Brounen et al., 2004) (and may be required to use) more sophisticated methods, that is, aside from being a measure of complexity, size captures other influences. We therefore also include SIC, a measure for firm-level diversification (proxying complexity and/or multiple levels of management), calculated as the number of different SIC codes for the firm at the second digit level. We also use a combined variable, Large_and_Div, which is a combination of a dummy variable, taking the value of 1 for firms with sales in excess of one billion euros, and the above SIC variable. This interaction variable is included to test for size-related nonlinearities in the effect of SIC on capital budgeting. We expect a negative sign for SIC as our main variable for firm complexity in the capital budgeting equation and a positive sign in the hurdle rate model.

Martin (2008) suggests that owner-run/owner-controlled companies will be less subject to such agency problems, which influence capital budgeting methods. Such firms would thus be more likely to use a firm value maximising decision rule, that is, the NPV, as the single main method. Moreover, in line with Berkovitch and Israel (2004), we expect that higher hurdle rates will be used by large divisionally organised firms such as the multinationals, and these in turn typically have a more dispersed ownership (lacking a very large owner). We include the variable Large_owner, defined as the largest owner's share of equity, to test for differences between firms with a high versus low level of ownership control and expect a positive sign for it in model (1) and a negative one in the hurdle rate model (2).

4.2.3 Political risk

According to hypothesis 3, we expect that higher political/country risk is associated with higher hurdle rates and less sophisticated capital budgeting methods. Holmén and

Pramborg (2006) find that the use of NPV decreases with the political risk of the host country, while the use of the payback increases. We study firms in the Nordic countries, which are rather homogeneous in terms of political risks. We include country dummies for Denmark, Finland and Sweden, leaving Norway and the few Icelandic firms to be represented by the intercept. These dummy variables may, among other factors, capture potential differences in country risk premiums (in the hurdle rate models) as well as differences in political risks.

4.2.4 CFO characteristics

According to our hypothesis 4, we expect that older and less educated managers will prefer less sophisticated capital budgeting methods. To proxy for the level of the CFO's education, we include a dummy CFO_edu, which takes the value of one if he has an MBA or a university degree in economics/management. We also include the variable CFO_age, which measures the age of the CFO in full years. As an alternative to CFO_age, we use the variable CFO_age_above_50, a dummy variable taking the value of one if the CFO is older than 50, and zero otherwise. We also include these in the hurdle rate equation to test for potential effects related to the 'hurdle rate puzzle,' that is, we expect a smaller hurdle rate premium in firms with a younger CFO and a CFO with an education in economics/business.

4.2.5 Short-term pressure

According to our hypothesis 5, we expect that firms subject to higher short-term pressure will use higher hurdle rates and other capital budgeting methods than the NPV (i.e. will have a preference towards the payback method). Using high hurdle rates favours projects producing cash-flows in the near future, and moreover, Liljebloom and Vaihekoski (2009) found support for a relationship between a short-term orientation and a high hurdle rate. As suggested by Thakor (1990), using the payback method, projects giving results soon can easily be identified and preferred. We include the variable CFO_pressure, which is based on the CFO's reply to the question 'to what extent do you feel that short-term external expectations conflict with company's long-term goals?' The respondents we offered alternatives from 1 (very little) to 5 (very much). The mean answer to the question was 2.73. We expect that firms subject to more short-term pressure will be more inclined to use other methods than the NPV (i.e. to use also the payback method) and to use a higher hurdle rate.

Finally, we include FIN_SEC and IND_SEC as dummies for the financial and the industrial sector. These are the two largest sectors in our sample, and 72 firms (46 per cent of our sample) belong to these. Moreover, these sectors are of some special interest. The financial sector may be expected to know financial tools and thus apply more sophisticated methods, whereas the industrial sector is likely to have on average bigger, long-term investments with real option features. The use of a dummy for industrials also increases the comparability of our results to those of, for example, Hermes et al. (2007) and Holmén and Pramborg (2006).¹⁵

¹⁵ Descriptive statistics for our variables can be obtained from the authors. The correlations between our explanatory variables are not generally high, mostly between -0.2 to $+0.2$ (about half of them between -0.1 and $+0.1$). Besides three slightly higher negative correlations between pairs of country, or sector dummies, the higher correlations are mainly found for our size variable Ln_sales, with a correlation of 0.55 (the only one above 0.3) with ROA, and the highest negative correlation of -0.29 with Past_Growth.

5 SURVEY RESPONSES

5.1 The investment evaluation method

We asked the companies to indicate what kinds of investment evaluation methods they use. A list of different methods was given with an option to provide their own. Respondents were asked to select only one primary method, but they could also select a number of secondary methods as well as indicate methods that are used only in special cases.

Table 1 summarises the results. We received responses from 155 firms (CFOs) to this question. Contrary to the instructions, in some cases, firms selected several methods as their primary investment evaluation method, giving us 219 replies. The most popular method was, as expected, the NPV. Among the responding firms, 64 (41.29 per cent) indicated it as their primary method with an additional eight (5.16 per cent) indicating that they use NPV analysis combined with real options analysis. However, even taking both categories (46.45 per cent) into account, the use of the NPV method in the Nordic companies seems far less common than in the US. According to Graham and Harvey (2001), the NPV method was used by more than 74 per cent of US firms.

Despite its theoretical problems,¹⁶ the payback period method was the second most popular method (25.16 per cent). In the US, the payback rule is even more popular, according to Graham and Harvey (2001). They found that 55 per cent of firms either always used it or almost always used it. The next most popular methods in our study were the IRR (19.35 per cent) and accounting measures and earnings multiples (both used by 17.42 per cent of the respondents). Analysing secondary methods and methods in special cases shows that almost all methods were quite popular. The difference between primary and secondary methods is biggest for the sensitivity analysis, which, along with the payback, was the most popular secondary method.

5.2 The required rate of return

The respondents were also asked what their required rate of return for the whole company (WACC) was. The respondents could also answer with 'not calculated'. Out

¹⁶ The payback method ignores, for example, the time value of money and cash flows beyond the cut-off date, and there is no clear decision criterion to determine whether or not to invest.

of 146 responses to this question, a surprisingly high number of companies, 62 (42.5 per cent), answered that the WACC is not calculated for their respective companies. A WACC was calculated by 84 firms, a number closely corresponding to that in Meier and Tarhan (2007). However, the percentage of companies calculating a WACC (57.5 per cent) is clearly lower than what, for example, Meier and Tarhan (2007) found in their survey of the largest US companies (71.8 per cent). This may be due to the use of DCF techniques as well as the CAPM approach is lagging in the Nordic countries compared to the USA (c.f. Liljeblom and Vaihekoski, 2009) or due to the use of different methods of defining hurdle rates for the DCF-analysis.

Table 1 The investment evaluation methods

The relative frequency of different investment criterion is given in the table. Column N (firms) indicates how many companies (out of the total of 155 responses to this specific question) chose the given methods as their primary, secondary, or occasional investment evaluation criteria. Columns labelled as 'N' and '% of firms' indicate the relative frequency (percentage of firms) of the given method in companies (out of the total). The respondents could choose several methods as their primary, secondary or occasional investment evaluation methods.

Criteria	N (firms)	Primary			Secondary			In some cases		
		N	% of firms	% of responses	N	% of firms	% of responses	N	% of firms	% of responses
Accounting or Book Rate of Return (ROE, ROA etc.)	82	27	17.42	12.33	31	20.00	10.51	24	15.48	15.09
Earnings multiple	81	27	17.42	12.33	29	18.71	9.83	25	16.13	15.72
Economic Value Added (EVA)	61	6	3.87	2.74	28	18.06	9.49	27	17.42	16.98
Internal Rate of Return	86	30	19.35	13.70	41	26.45	13.90	15	9.68	9.43
Net Present Value (NPV)	119	64	41.29	29.22	38	24.52	12.88	17	10.97	10.69
NPV adjusted with real options analysis	43	8	5.16	3.65	14	9.03	4.75	21	13.55	13.21
Payback period	107	39	25.16	17.81	57	36.77	19.32	11	7.10	6.92
Sensitivity analysis	90	14	9.03	6.39	57	36.77	19.32	19	12.26	11.95
Other	4	4	2.58	1.83	0	0.00	0.00	0	0.00	0.00
N (criteria chosen)	155	219		100.00	295		100.00	159		100.00

The first row indicates the total number of methods chosen. Columns labelled as '% of responses' indicate the relative frequency of the given method among all methods in each category.

The average WACC was 10.69 per cent with a median of 10.00 per cent. The highest WACC reported was 25.0 per cent, and the minimum was 6.5 per cent. Only three companies provided WACCs equal to or higher than 20 per cent, suggesting surprisingly low cross-sectional dispersion as suggested by the low standard deviation (3.31 per cent). Analysing the results across different countries, we found that the highest WACC was set by Norwegian companies (12.13 per cent) and the lowest by the Swedish companies (10.09 per cent). The difference is not statistically significant (a t-value of 0.96).

Our results differ slightly from, for example, Meier and Tarhan (2007), who found out that the mean WACC for the US companies within their sample was 14.1 per cent, with a median of 14.0. It is clearly higher than what we found, but it may be partly explained by the different timing of the surveys (2003 for theirs versus 2007 for ours) as well as other differences in the samples.

In addition, we asked the companies to give more detailed information about the required rate of return. First, we asked how often the required rate of return changes. The results are partly conflicting as 117 companies responded to this question, even though 62 companies earlier indicated that they do not calculate WACC (which would have left, at most, 95 potential companies to answer this question). Because the question did not specifically relate the change to the WACC rather than 'the rate of return,' the high number of responses for this question might be interpreted as partial support for the hypothesis that firms may use methods other than the WACC to define their required (hurdle) rates. Nevertheless, the overall results indicate that the companies update their targeted WACCs annually (53 per cent of the respondents). This is almost similar to what Liljeblom and Vaihekoski (2004) found for Finnish companies (60 per cent). Few companies (six per cent) indicate that they do not update their required rate of return at all (or at least have not updated it thus far). A slightly higher number of companies (17.1 per cent) update their WACC more frequently than once a year.

Second, we asked whether the length of an investment project affects the required rate of return. For close to half of the companies (46.3 per cent), the required rate of return can differ across different projects, even if they had an equally long time span. In 19.8 per cent of the companies, the required rate stays the same for all projects, leaving 33.9 per cent of the companies to fall in between these two groups, keeping the rate the same for most of the projects but not all of them. When asked whether the

required rate of return increased with the length of the investment project, the vast majority (85.6 per cent) of the respondents answered that it did not increase, 12.2 per cent indicated that the required rate of return was higher for longer projects, and 2.2 per cent responded that it actually was lower. The results are partly conflicting with the finance literature, as many books seem to advocate higher required rates for longer investment projects to account for term structure and the higher risk involved with cash flows that stretch far into the future.

Finally, we asked a set of questions on the required rate for individual investment projects. Respondents could give one primary method and several secondary methods and, on a case-by-case basis, choose from a list of alternative methods, which included the answer that no required rate of return was set/no method was used. 29.41 per cent of the respondents use the WACC for the whole company also for different investment projects. Almost as many firms adjust their WACC for project risk (26.14 per cent). Only a few firms adjust their WACC for the division's risk (3.27 per cent) or country's risk (5.23 per cent). These results resemble those of Graham and Harvey (2001) using a related set of questions. They found that 58.79 per cent of the companies always, or almost always, use the company-wide discount rate. However, surprisingly many companies in our survey state that they base the investment's required rate purely on the project's risk (13.73 per cent) or on the equity and debt mix used to finance the project (9.15 per cent).¹⁷

¹⁷ We also asked about the setting of the required rate for the equity. 14.4 per cent of the respondents admit that no required rate of return is set for the equity, while 29.03 per cent answered that the rate of return is set by top management. Versions of the CAPM were chosen by 34.6 per cent of the companies. Analysing the result country-wise, we find that versions of the CAPM are most common in Finland (used by 54.2 per cent of the responding firms), followed by Norway (37.5 per cent), Denmark (31.3 per cent), Sweden (28.2 per cent) and Iceland (16.7 per cent).

6 CHOICE OF CAPITAL BUDGETING METHOD AND HURDLE RATE

6.1 Determinants of the main capital budgeting method

In this section, we will first analyse the choice of NPV as the main method and then test a model for the sophistication of the capital budgeting method.

Estimations for the choice of the NPV method as the primary one are conducted using robust probit models, in which the dependent variables are regressed on country and sector dummies, firm size, proxies for real options and agency problems, and on other variables such as CFO_pressure and CFO characteristics. Our first model is as follows:

$$NPV_as_primary_i = \lambda_0 + \lambda_1(AC)_i + \lambda_2(RO)_i + \lambda_3(CD)_i + \lambda_4(Behs)_i + \lambda_5(Ctrls)_i + e_i, \quad (3)$$

where AC_i is a vector of variables proxying for agency costs (Ln_sales , which also is likely to capture other effects besides agency costs, $OWN_largest$, SIC , and $Large_and_Div$), RO_i is a vector of variables proxying for the existence of real options ($Past_Growth$ and ROA), CD_i stands for three country dummies (DEN , FIN , and SWE for Denmark, Finland and Sweden; the coefficients for these three countries will thus measure the marginal effects as compared to the countries without a dummy, Norway and Iceland), $Behs_i$ as a vector of variables for behavioural reasons and characteristics ($CFO_pressure$, CFO_age , CFO_edu , and $CFO_age_above_50$), and $Ctrl_i$ represent other control variables (the two sector dummies, FIN_SEC and IND_SEC , for the financial and industrial sectors, respectively).

Table 2 reports the results for Equation (3) under different specifications. The results from model 1 show that there are significant differences between countries in the use of NPV as a primary method. Finland and Sweden obtain negative coefficients (which, in the later specifications, are sometimes significant), whereas the method is significantly more common in Denmark as compared to all the other countries.¹⁸ The financial sector also obtains a significant coefficient in model 1.¹⁹

In model 2 of Table 2, we have extended the model by including all but the CFO characteristics. In line with previous studies, size is a significant determinant of the sophistication of capital budgeting, exemplified here as a significantly more common use of the NPV method as a primary tool. We also obtain the expected negative sign for ROA as a proxy for real options and a less frequent use of the NPV as the primary method (whereas the other proxy for real options, Past_Growth, is insignificant, with a sign different from expectations). Finally, OWN_largest is significant but with a negative sign. This result is contrary to the prediction by Berkovitch and Israel (2004). Because our other agency cost variable, SIC, obtains the expected negative sign but is insignificant, we also estimate a new version of the model, adding the variable Large_and_div. This specification, reported in model 3, allows for a test of the linearity of SIC, that is, whether firm complexity influences the use of NPV differently in different size categories. The new specification strengthens the basic SIC but not enough to gain significance.

Models four and five of Table 2 test the effect of CFO characteristics on the use of NPV. CFO_age and CFO_edu both obtain the expected signs but are not quite significant in model 4. When CFO age is replaced by a dummy for CFOs older than 50 years, the variable is significant at the five per cent level in model 5, indicating that NPV is less often used by such firms.

Next, we test determinants of the 'sophistication' of capital budgeting by a model otherwise identical to Equation (3) and model 4 in Table 2, but now with a

¹⁸ The significantly positive coefficient for Denmark both indicates a significant difference (a marginal effect) with respect to the countries left without an intercept (Norway and Iceland), but also that negative coefficient estimates (Finland and Sweden) do not belong to the 10 per cent confidence interval for Denmark. Specification tests confirm that Finland and Sweden are significantly different from Denmark, but that besides for Denmark, significant differences cannot be found among the other countries.

¹⁹ Robustness tests reveal that the results for our other variables in Table 2 are not especially sensitive for the specification of the sector dummies. Sectors left without a sector dummy are energy and materials, consumer goods, healthcare and it & telecom.

Table 2 Determinants of NPV as a primary method

The table reports results from robust probit estimations where an indicator variable NPV_as_primary is regressed on country and sector dummies, logarithmic sales, the past year's sales growth, return on assets, that is, ROA, OWN_largest (the per cent of equity owned by the largest owner), SIC, that is, the number of SIC codes for the firm at a two-digit level, Large_and_div, that is, an interaction variable of SIC codes for large firms, CFO pressure for short-term actions (a survey response variable) and CFO characteristics (CFO_age or CFO_age_above_50, and CFO_edu).

Model	Model 1	Model 2	Model 3	Model 4	Model 5
DEN	0.5532 (1.67)	0.7308 (1.86)	0.7905 (2.06)	0.5967 (1.25)	0.5963 (1.24)
FIN	0.5780 (1.59)	0.6391 (1.56)	0.5830 (1.41)	0.8617 (2.07)	0.8805 (2.04)
SWE	0.3160 (1.09)	0.3047 (0.93)	0.2808 (0.87)	0.5044 (1.52)	0.5787 (1.75)
FIN_SEC	0.6483 (2.07)	0.5808 (1.61)	0.5882 (1.61)	0.3619 (0.96)	0.4044 (1.08)
IND_SEC	0.1297 (0.53)	0.0752 (0.28)	0.0773 (0.28)	0.2370 (0.82)	0.2024 (0.69)
Ln_sales		0.1805 (2.87)	0.1158 (1.56)	0.2039 (2.96)	0.1979 (3.02)
Past_Growth		0.0437 (0.63)	0.0331 (0.88)	0.0320 (1.54)	0.0316 (1.57)
ROA		0.0283 (3.08)	0.0244 (2.55)	0.0283 (2.64)	0.0272 (2.64)
OWN_largest		0.0152 (2.39)	0.0171 (2.60)	0.0167 (2.33)	0.0176 (2.46)
SIC		0.0591 (0.64)	0.1123 (1.19)	0.0529 (0.53)	0.0736 (0.71)
Large_and_div			0.1969 (1.53)		
CFO_pressure		0.0736 (0.68)	0.1069 (0.98)	0.0656 (0.57)	0.0286 (0.24)
CFO_age				0.0307 (1.60)	
CFO_age_above_50					0.6136 (1.98)
CFO_edu				0.5539 (1.32)	0.5862 (1.38)
Observation (N)	155	138	138	129	129
Wald χ^2	16.00	28.30	35.21	30.50	36.09
Pseudo R ²	0.0746	0.1591	0.1708	0.1957	0.2036

Coefficient estimates are reported on the first row for each variable, followed by a z-value in parentheses. Significant z-values at the 10% level are reported in bold type.

sophistication index as the dependent variable, and using robust ordered probit models. Table 3 reports the results.

The results are mainly in line with our previous findings. The use of more sophisticated methods is significantly positively related to firm size and negatively related to ROA and OWN_largest.²⁰ When we move to more sophisticated methods, the positive relationship to the CFO having an economic education grows in significance.

²⁰ Robustness tests reveal that the most correlated variable, Ln-sales, is still significant in the same models as before in Table 2, when dropping the variables it is mostly correlated with (ROA and Past_Growth), and that ROA in turn keeps it significance in those models even without Ln-sales.

Table 3 Determinants of the sophistication of the capital budgeting method

The table reports results from robust ordered probit estimations where indicator variables for the sophistication of capital budgeting (Index_1 to Index_4) are regressed on country and sector dummies, logarithmic sales, the past year's sales growth, return on assets, that is, ROA, OWN_largest (the per cent of equity owned by the largest owner), SIC, that is, the number of SIC codes for the firm at a two-digit level, CFO pressure for short-term actions (a survey response variable), and CFO characteristics (CFO_age, and CFO_edu).

Model	Model 1	Model 2	Model 3	Model 4
Dependent variable	Index_1	Index_2	Index_3	Index_4
DEN	0.3440 (0.80)	0.4610 (1.23)	0.3966 (1.02)	0.5178 (1.46)
FIN	0.6244 (2.05)	0.4308 (1.37)	0.6537 (2.07)	0.5418 (1.82)
SWE	0.5074 (1.88)	0.4397 (1.59)	0.5999 (2.12)	0.5287 (2.00)
FIN_SEC	0.0827 (0.26)	0.1950 (0.68)	0.2999 (1.02)	0.3242 (1.12)
IND_SEC	0.2432 (1.04)	0.0263 (0.11)	0.0416 (0.16)	0.3319 (1.40)
<u>ln_sales</u>	0.1151 (2.32)	0.1824 (2.98)	0.2077 (3.24)	0.2160 (3.72)
<u>Past_Growth</u>	0.0239 (1.87)	0.0534 (0.78)	0.0746 (0.85)	0.0628 (0.70)
ROA	0.0167 (1.82)	0.0196 (2.43)	0.0214 (2.76)	0.0228 (2.94)
<u>OWN_largest</u>	0.0119 (1.95)	0.0135 (2.14)	0.0167 (2.41)	0.0145 (2.28)
SIC	0.0317 (0.43)	0.0327 (0.45)	0.0169 (0.22)	0.0074 (0.10)
<u>CFO_pressure</u>	0.0250 (0.26)	0.0189 (0.22)	0.0046 (0.05)	0.0067 (0.08)
<u>CFO_age</u>	0.0161 (1.13)	0.0081 (0.56)	0.0075 (0.49)	0.0061 (0.41)
<u>CFO_edu</u>	0.1084 (0.42)	0.3448 (1.72)	0.4910 (2.10)	0.4952 (2.09)
Observation (N)	129	129	129	129
Wald χ^2	29.37	28.86	38.18	42.63
Pseudo R ²	0.0667	0.0797	0.0952	0.0952

Coefficient estimates are reported on the first row for each variable, followed by the z-value in parentheses. Significant z-values at the 10% level are reported in bold type.

The results in this section support earlier findings on the use of NPV and more sophisticated methods, that is, that such use is more common in larger firms. We also find support for ROA as a real option proxy, that is, in more profitable firms, the use of methods other than the NPV is more common. Surprisingly, firms controlled by large owners also use NPV significantly less often. Because ownership levels in the Nordic countries are often very high, this may be a sign of an entrenchment effect (agency problems between the large owner and other owners) in such firms. Alternatively, the sophistication level and/or the preferences of the large owners may play a role. Finally, we find that the sophistication level of capital budgeting methods is increasing in the CFO's economic/business education.

6.2 Determinants of the hurdle rate

Next, we study the determinants of the hurdle rate premium. Our estimated WACC_theor is, on average, 6.68 per cent (with a standard deviation of 1.75), that is,

much lower than the reported WACC in the survey. The estimated hurdle rate premium (WACC_prem) has a mean of 3.99 per cent and ranges from)4.12 to +18.92 per cent. The average premium is significantly in excess of zero (a t-value of 8.95) and would be so also in the case that we would use a corporate bond yield and an equity premium that are two-percentage points higher. Our estimates for the hurdle rate premium are close to those made by Meier and Tarhan (2007) for the US. Assuming an equity premium of 6.6 per cent (3.6 per cent), they obtained in their monthly model averages of 5.28 per cent (7.45 per cent), with a range between) 6.96 per cent and 21.07 per cent (0.51 per cent and 27.71 per cent).

Our basic model is similar to Equation (3), but in this case, we are using WACC_prem as the dependent variable and estimating robust regression models of the following form:

$$WACC_prem_i = \lambda_0 + \lambda_1(AC)_i + \lambda_2(RO)_i + \lambda_3(CD)_i + \lambda_4(Behs)_i + \lambda_5(Ctrls)_i + e_i \quad (4)$$

where AC_i is a vector of proxies for agency costs (Ln_sales, also likely to capture other effects besides agency costs, OWN_largest, and SIC), RO_i is a vector of proxies for real options (Past_Growth and ROA), CD_i stands for country dummies (DEN, FIN, and SWE), Behs_i captures proxies for behavioural reasons (CFO_pressure, CFO_age, CFO_edu) and Ctrl_s_i stands for control variables (FIN_SEC and IND_SEC, dummies for the financial and industrial sectors). To test for a relationship between the use of sophisticated capital budgeting methods and a hurdle rate premium, we also include Index_4 in a final specification of the model. The results for versions of Equation (4) are reported in Table 4. Model 1 reveals signs of significant country and sector differences. The country dummies are all negative, and significant differences from the countries left without a dummy are detected for Denmark (at the 10 per cent level) and Sweden (at the one per cent level). The dummy for the financial sector is also positive and significant at the five per cent level, indicating a higher hurdle rate premium.

When additional explanatory variables are added to the model, almost none of them are significant, and even the significance levels of the dummy variables decrease. Only in model 4, where a measure of capital budgeting sophistication is included in the form of

Index_4, is that variable significant together with CFO_pressure.²¹ The latter indicates that hurdle rates are higher in firms where the CFO experiences a larger pressure for short-term results, that is, a result in line with the one found by Liljeblom and Vaihekoski (2009) for Finland. The negative sign and significance of Index_4 in turn implies that firms using more sophisticated capital budgeting methods also use more modest hurdle rates (and thus, firms with less sophisticated models, on average, use hurdle rates higher than the theoretical one). This result is in line with predictions from both the real options as well as agency cost categories, as explanations from both categories combine the use of higher hurdle rates with a higher use of multiple methods and 'rules of thumb'.

²¹ We have chosen to report results using Index_4, since it is based on the largest number of different survey questions, and therefore, relatively to the others, likely to capture most of the cross-sectional variation in the firms' capital budgeting methods. Robustness tests reveal that the results are pretty robust to the choice of the index, for example, CFO_pressure is always significant, with t-values ranging between 1.68 as the lowest (using Index_4 as in Table 4) to 1.80 as the highest (using Index_3). The index itself is also systematically significant, with t-values between)2.25 at the lowest (for Index_4) to)2.71 as the highest (for Index_3). Even NPV_as_primary produce similar results when included as an explanatory variable for the WACC_prem. The indexes as well as NPV_as_primary are highly correlated, with values ranging from 0.78 (between Index_4 and NPV_as_primary) to 0.99 (between Index_1 and Index_2). In general, a measure for investor sophistication (either an index or NPV_as_primary) turns out to be the single most important determinant for the hurdle rate premium, highly significant (mostly at the one per cent level) in all specifications, starting from single regressions.

Table 4 Determinants of the hurdle rate

The table reports results from robust regressions where WACC_prem (the difference between a survey response WACC and a theoretical WACC) is regressed on country and sector dummies, logarithmic sales, the past year's sales growth, return on assets, that is, ROA, OWN_largest (the per cent of equity owned by the largest owner), SIC, that is, the number of SIC codes for the firm at a two-digit level, CFO pressure for short-term actions (a survey response variable), CFO characteristics (CFO_age and CFO_edu), and a proxy for sophisticated capital budgeting methods, Index_4.

Model	Model 1	Model 2	Model 3	Model 4
Intercept	5.5903 (4.83)	5.1878 (1.58)	7.7686 (1.89)	10.3058 (2.30)
DEN)2.5836 (1.79))2.4385 (1.07))3.3558 (1.49))3.1545 (1.43)
FIN)1.2020 (0.87))0.8849 (0.39))1.2448 (0.54))1.9311 (0.82)
SWE)3.0769 (2.44))2.9092 (1.26))3.1620 (1.37))3.6112 (1.52)
FIN_SEC	3.5443 (2.06)	3.8486 (2.06)	3.1115 (1.39)	2.6282 (1.29)
IND_SEC)0.5347 (0.72)	0.0681 (0.08)	0.0526 (0.06)	0.1371 (0.16)
<u>Ln_sales</u>)0.1760 (1.16))0.1285 (0.84))0.0240 (0.15)
<u>Past_Growth</u>)0.0375 (1.43))0.0353 (1.38))0.0265 (1.04)
ROA)0.0063 (0.12))0.0041 (0.08))0.0153 (0.33)
<u>OWN_largest</u>		0.0332 (1.34)	0.0392 (1.62))0.0315 (1.28)
SIC)0.1173 (0.39)	0.0211 (0.07))0.0391 (0.13)
<u>CFO_pressure</u>		0.6104 (1.56)	0.5796 (1.52)	0.6401 (1.68)
<u>CFO_age</u>)0.0416 (0.70))0.0483 (0.83)
<u>CFO_edu</u>)1.3450 (0.53))1.3675 (0.55)
Index_4)0.6504 (2.25)
Observation (N)	83	76	74	74
F-value	3.63	2.65	2.79	2.48
R ²	0.2115	0.2462	0.2491	0.2889

Coefficient estimates are reported on the first row for each variable, followed by the z-value in parentheses. Significant z-values at the 10% level are reported in bold type.

7 CONCLUSIONS

Using survey data for five Nordic countries, we study the determinants for the choice of capital budgeting methods and the hurdle rate (WACC) in investment evaluation. We contribute to prior studies through a broader set of explanatory variables, based on real options, agency problems and CFO characteristics. Aside from CFO age and education, we test a novel variable in this setting, the pressure to produce a good result in the short term.

We find that the use of DCF methods, especially the NPV, is still much less common in the Nordic countries compared to the US. It is used as a main method in 41.29 per cent of the firms (and 5.16 per cent use NPV with real options), while Graham and Harvey in 2001 report that more than 74 per cent of US firms were using the NPV. The second most common method in our study is the payback method (used by 25.16 per cent). As determinants for NPV as a primary method, we find support for variables relating to real options (return-on-assets, as a proxy for growth options). We also find support for behavioural characteristics: NPV is used significantly less often in firms where the CFO is older than 50 years.

Using the survey responses to questions related to the choice of the capital budgeting method and the hurdle rate for projects, we create several (highly correlated) proxies for the sophistication of the capital budgeting in the firm. As determinants for such indexes, we find support for the same variables as before (e.g. ROA, with a negative impact), but we also find that the sophistication of capital budgeting is increasingly (for broader indexes) related to the CFO having an education in economics/business.

Finally, we study the setting of the hurdle rate. We thereby contribute to the literature concerning the 'hurdle rate puzzle,' that is, the empirical observation that the hurdle rates (WACCs) used by firms tend to be higher than those suggested by economic theory. We contrast the WACC rates obtained from the survey with the 'theoretical' hurdle rates constructed by ourselves on the basis of the CAPM and empirical inputs for the return on equity and debt, empirical tax rates and the firm's capital structure. The difference between these two rates (the WACC premium) ranges between -4 per cent and +19 per cent, with a mean of four per cent, which is close to that found by Meier and Tarhan (2007). When studying the determinants for the hurdle premium, we find weak support for the pressure felt by the CFO as a positive determinant. This result is in line with Liljeblom and Vaihekoski (2009), who find

support for a relationship between the owners of a firm (more short-term or long-term oriented owners) and their choice of capital budgeting methods (a higher WACC and a shorter payback time being used by firms with more short-term owners). We also find a significant relationship between our proxies for the sophistication of the capital budgeting and the hurdle rate premium: higher hurdle rates are used by firms that score lower in the sophistication index.

The economic significance of our findings can be exemplified by the hurdle rate premium. We estimate an average hurdle rate premium of four per cent for our sample. Assuming that this figure would be representative for the whole market and that, for example, one-fourth of its level (i.e. one per cent) would be a true misspecification (e.g. an overstatement caused by behavioural reasons), the economic losses in terms of underinvestment in the Nordic countries would be very large.²²

Our study is limited to survey responses collected for listed firms in the Nordic countries. A fruitful line for research might be to perform more in-depth studies of capital budgeting methods in firms. Both the actual divisional practices and the hierarchies in the decision-making, as well as the actual inputs in the project calculus could be studied, because projects of different size and strategic importance are typically dealt with in different ways and with different precision. A study which would combine such detailed data on company practices with a large enough cross-section of firm characteristics and financials might provide useful information on the true size and nature of a potential hurdle rate premium.

²² Assuming an elasticity of investments to the cost of capital of 0.7 (Gilchrist and Zakrajsek, 2007), and an elasticity of GDP to investments of about 0.3 (Bassanini and Scarpetta, 2001), a change of the cost of capital from 10.68 per cent (our sample average) to, for example, 9.68 per cent (i.e. a percentage change of 9.36 per cent in the level of the cost of capital) would increase investments by 6.55 per cent, and GDP by 1.97 per cent. Naturally, such inference is subject to a lot of uncertainty due to potential estimation errors in each elasticity. The aggregate GDP in the five Nordic countries in 2008 was 1082.6 billion USD (OECD statistics, at the current prices of 2011).

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