

EMPIRICAL EVIDENCE ON THE DISCREPANCY BETWEEN CAPITAL BUDGETING THEORY AND PRACTICE: A SURVEY OF ESTONIAN ENTERPRISES

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Abstract

This study examines investment project appraisal practices in Estonian firms using survey data from 106 companies. The results show that although more than half of the respondents frequently use at least one method recommended by financial theory such as NPV, IRR, or ROV, firms often rely on intuition or simpler evaluation techniques including the payback period and ARR, particularly when assessing smaller projects. Investment appraisal is typically based on pre-tax cash flows, and a non-negligible share of firms fail to correctly incorporate the effects of opportunity costs, sunk costs, and inflation. Overall, the findings support prior evidence that capital budgeting practices in larger firms are more closely aligned with financial theory.

Keywords: Capital budgeting, cost of capital.

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Introduction

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Regardless of whether an investment decision is made at the level of an individual, a company, or the state, the assessment of an investment's financial profitability is largely based on similar principles. As many investments in Estonia are currently co-financed by the European Union, it is essential to understand capital budgeting techniques not only in the business sector but also at national and local government levels. Insufficient knowledge of these methodologies may lead to suboptimal decisions that reduce welfare for both firms and the state.

Capital budgeting is an area in which there is relatively strong academic consensus regarding the appropriate methodological approach. Investment appraisal should rely on methods that incorporate the time value of money and should be based on after-tax nominal incremental cash flows generated by the investment, considering all opportunity costs while disregarding all sunk costs. The discount rate applied to investment-related cash flows must reflect the associated risks and should be grounded in market conditions.

Over the past half-century, hundreds of surveys have been conducted in various countries to examine whether and how these theoretical recommendations are applied in practice. For Central and Eastern European countries, such studies are considerably fewer, and in one of the most extensive surveys, conducted in 2015 by Andor, Mohanty, and Toth, Estonia was not included. In the early 2000s, H. Hammer carried out a small-scale survey with a highly specific sample on investment decision-making in Estonian companies; however, due to the specificity of the sample, the results did not provide a representative overview of the practices of Estonian firms. The present study seeks to fill this gap by examining not only which methods companies employ but also, for selected aspects, how these methods are implemented in practice.

The objective of this study is to identify the capital budgeting practices employed by Estonian companies and to assess the extent to which these practices align with recommendations found in the theoretical literature. To this end, a survey was conducted among Estonian firms in 2021.

The article is structured as follows. The first section outlines the theoretical principles that should guide financial feasibility analysis. The second section provides a brief description of the sample and methodology, and the third section presents the survey results and corresponding conclusions. The article concludes with a summary section.

Theoretical Overview

In corporate finance literature, it is recommended that investment appraisal should be based on methods that account for the time value of money - primarily the project's net present value (NPV). This analysis should be based on the project's incremental nominal after-tax cash flows, considering all opportunity costs while ignoring sunk costs. For discounting cash flows, a market-based discount rate is

advised, one that corresponds to the nature and risk level of the cash flows. The following sections provide a more detailed theoretical discussion of these aspects as presented in the literature.

Choice of Method

Although corporate finance textbooks present and practitioners employ both DCF-based methods (e.g., net present value (NPV), profitability index (PI), internal rate of return (IRR), modified internal rate of return (MIRR), and discounted payback period (DPP)) as well as more simple methods that do not account for the time value of money (payback period (PP), accounting rate of return (ARR)), finance theory unequivocally recommends prioritizing the former. In many cases, it is useful to compute several different profitability indicators, as they provide insights into the project's performance from different perspectives (monetary, percentage-based, and time-related). This, however, does not mean that they are all the same importance as a guide to make better decisions and the NPV is regarded as the theoretically superior criterion (Baker and Powell, 2005). For projects characterized by high uncertainty, academics recommend the use of real options valuation (ROV) (Baker et al., 2010).

Numerous earlier survey studies on large firms in developed countries have shown that while in the 1960s and 1970s investment appraisal relied predominantly on the payback period and accounting-based performance indicators (Istvan 1961), subsequent decades have seen DCF-based techniques emerge as the primary methods for evaluating investment profitability in large enterprises (Bruner et al. 1998; Graham and Harvey 2001; Ryan and Ryan 2002; Baker et al. 2011; Atrill 2019). Although the payback period continues to be used frequently, in large firms it tends to function more as a secondary appraisal method (Graham and Harvey 2001).

Until the turn of the century, the IRR dominated among DCF methods in terms of usage (Gitman & Forrester 1977; Schall et al. 1978; Pike 1996). Since the 2000s, however, the use of NPV has risen to a comparable level (Graham and Harvey 2001; Ryan and Ryan 2002) and has even slightly surpassed it (Bennouna et al., 2010, Graham et al., 2015). From a theoretical perspective, NPV is clearly superior, as IRR may suffer from both computational and interpretative problems, and its correspondence to actual economic conditions depends on the strict assumption that interim cash flows are reinvested at the IRR itself.

Real options valuation entered practical use relatively recently (primarily in the 2000s) and has remained largely confined to large corporations. Its adoption is relatively modest even among major firms: for example, in U.S. large companies, the real options method was used by between 14.3% (Block 2007) and 27% (Graham and Harvey 2001) of firms; among publicly listed firms in Canada, approximately 16.8% employed it (Baker et al. 2011); in Sweden, Norway, and Denmark, only 6% of large companies reported its use (Horn et al. 2015); and in Pakistan, 3.5% of firms applied the method (Baig & Khalidi 2020).

In contrast, among smaller firms the payback period remains one of the principal criteria in investment decision-making (Danielson and Scott 2006; Hasan 2013; Daunfeldt and Hartwig 2014; Rossi 2014). A considerable proportion of small enterprises do not employ any formal appraisal method at all but instead rely on managerial intuition (Atrill 2019), a tendency frequently attributed to the limited awareness among small-firm managers of capital-budgeting techniques (Rossi 2014; Sarwary 2019). However, there are additional reasons why smaller firms tend to rely on simpler methods, including the absence of necessary information, and constraints related to time or financial resources (Sureka et al. 2022).

In Central and Eastern European countries - whose economic environments were characterized by higher levels of uncertainty and volatility, particularly during the 1990s - simpler methods retain substantial prevalence, and according to several studies, the payback period remains the most used investment appraisal criterion in capital budgeting (Dedi and Orsag 2007; Andor et al. 2015; Markovics 2016). At the same time, in large, listed companies, DCF-based methods continue to serve as the primary decision criteria (Pawlak et al. 2020).

Although the gap between theory and practice in the choice of investment appraisal methods has clearly narrowed over time, DCF-based techniques lead to better investment decisions only if they are applied correctly.

Treatment of Sunk Costs

A normative framework in microeconomics (see e.g., Pindyck and Rubinfeld, 2013), corporate finance (see e.g., Berk and DeMarzo, 2020), and management accounting (see e.g., Horngren et al., 2022) consistently emphasizes that rational decision-making should be based solely on current and future incremental revenues and costs. Sunk costs - expenditures that have already been incurred or whose future occurrence is independent of the decision at hand - should be excluded from consideration.

In cost accounting, it is common practice to allocate overhead costs across projects, departments, or units using predetermined or arbitrary proportions (see e.g., Terzioglu, 2012). When evaluating new investments, it is crucial to determine whether these overhead costs are sunk in nature. Failure to adhere to this principle may result in suboptimal investment decisions, potentially leading to the rejection of projects with positive net present value (NPV), thereby diminishing firm value (Rich and Rose, 1995).

Despite the normative guidance, numerous empirical studies document the tendency of individuals to incorporate sunk costs into decision-making - a phenomenon known as the sunk-cost effect or the sunk-cost fallacy. This behavior is often driven by psychological factors such as regret aversion, mental accounting, self-justification, and waste aversion (see e.g. Arkes & Blumer, 1985, Statman and Caldwell, 1987). Arkes and Blumer (1985) define the sunk-cost effect as “a greater

tendency to continue an endeavor once an investment in money, effort, or time has been made.” Statman and Caldwell (1987) highlight that sunk costs are particularly influential in decisions regarding project termination, which, in principle, should follow the same evaluative criteria as project initiation. This bias is also prevalent in multi-stage investments such as R&D initiatives, large-scale infrastructure projects (Ross and Staw, 1993; Schmidt and Calantone, 2002).

Some scholars argue that under specific conditions, accounting for sunk costs may be rational - at least from the perspective of the decision-maker as an agent - due to the informational content of sunk costs, reputational concerns, or constraints related to time and financial resources (McAfee et al., 2010; Máñez et al., 2009). While such cases exist, the predominant drivers of sunk-cost sensitivity remain psychological or social in nature (Sleesman et al., 2012).

This topic has been explored only rarely in the context of capital budgeting survey research. In 2009, Meier and Tarhan found that over 52% of respondents reported taking sunk costs into account when making decisions about whether to accept or reject investment projects.

Treatment of Opportunity Costs

Opportunity costs are governed by a clear and unambiguous normative framework. Opportunity costs must be incorporated into decision making - specifically, the foregone returns resulting from the decision to undertake a particular investment (see e.g., Brealey et al., 2020). This principle has long served as a cornerstone in rational decision-making processes. However, experimental studies involving individuals reveal a tendency to overlook opportunity costs, particularly when their presence is not explicitly highlighted (Frederick et al., 2009).

According to the theory, all inputs used in a project must be valued at market prices, or in their absence, at shadow prices. Furthermore, opportunity costs may manifest in the form of constrained future investment possibilities. For instance, the execution of a current investment may preclude other potentially profitable ventures due to limited resources, thereby rendering certain real options valueless (Dixit & Pindyck, 1994).

Interestingly, surveys among corporate financial managers very rarely explicitly address the treatment of opportunity costs in capital budgeting, likely due to the assumption that their consideration is a fundamental tenet. Meier and Tarhan (2009) examined cash-flow cannibalization and found that approximately 81% of the firms in their study took it into account when estimating project cash-flows. Dedi and Orsag (2007) found that 46% of Croatian companies considered opportunity costs in their capital budgeting processes.

Consideration of Inflation

The literature (see e.g., Vélez-Pareja, 2006) identifies three primary approaches used in practice for forecasting investment project cash flows: the constant price method, the nominal price method, and the real price method. Theoretical studies (e.g. Van Horne, 1977, Rappoport & Taggart, 1982) have consistently demonstrated that employing constant prices in capital budgeting may lead to suboptimal or unjustified investment decisions.

Rappoport and Taggart (1982) argue that these three methods yield equivalent valuation outcomes only under specific conditions: namely, when the prices of all inputs and outputs associated with the project change at a uniform rate and when corporate income tax is absent. If even one of these assumptions is violated, the use of constant prices will not produce results consistent with those derived from nominal or real price-based approaches (*ibid.*).

A fundamental principle in financial analysis is the alignment of cash flow and discount rate types: nominal cash flows must be discounted using nominal rates, and real cash flows using real rates (Ross et al., 1999). Despite its simplicity, this principle is frequently overlooked in practice. The prevailing recommendation in theoretical literature is to rely on nominal prices for both cash flows and discount rates (Rappoport & Taggart, 1982, Quiry et al., 2011).

Vélez-Pareja (2006) provides a detailed list of conditions under which nominal and real price-based profitability analyses would yield identical results, ultimately advocating for the exclusive use of nominal prices. The use of real prices, he argues, tends to result in an overestimation of project profitability. Weston and Copeland (1992) demonstrate that in the presence of non-neutral inflation, these different methods may lead to divergent outcomes.

The combined effect of inflation and taxation on cash flows is influenced by the specific tax legislation of the country in question and may vary significantly across jurisdictions (Zurita et al., 2019). Consequently, principles applicable in one country may not be valid in another. Based on the existing body of literature, the most robust and theoretically sound approach to capital budgeting is to rely on nominal values for both cash flows and discount rates.

The importance that companies attach to incorporating inflation into capital budgeting has varied across countries and time periods. Pike (1996) found that among UK firms the use of adjustments to account for the effects of inflation had increased substantially, with 58% of companies making such adjustments. Six years later, Ryan and Ryan (2002) reported that only 31% of U.S. firms incorporated the impact of inflation into their cash flows. A study conducted a few years later in Greece and Cyprus showed that 72% and 55% of surveyed firms, respectively, took inflation into account (Lazardis 2006). In Croatia 41% of firms adjusted their cash flow estimates with inflation (Dedi and Orsag 2007). In India, managers considered inflation to be one of the most important risk factors in capital budgeting, and 73% adjusted either the discount rate and/or the cash flows (Batra and Verma 2017).

Even when firms attempt to incorporate the effects of inflation, they may not necessarily do so correctly. A survey conducted by Drury and Tayles (1997) revealed that only approximately 27% of the UK firms included in the study accounted for inflation in a methodologically sound manner. About a decade later, the situation among UK firms had improved significantly - 68% of companies incorporated the effects of inflation correctly (Meier and Tarhan 2009). However, studies in other countries (e.g., Waweru et al. 2005) have shown that accounting for inflation in a theoretically correct manner remains a challenge. In countries with high inflation, capital budgeting is often carried out in a stable foreign currency (Pereiro 2006).

Consideration of Taxes

Finance literature consistently recommends conducting capital budgeting using post-tax cash flows at the corporate level (see e.g., Brealey et al., 2020; Ross et al., 2019). This recommendation is grounded in several practical and theoretical considerations. First, the discount rate commonly used in practice (WACC) is derived from market data and reflects a post-tax rate. Employing pre-tax cash flows would necessitate converting WACC to a pre-tax equivalent, a process that is both complex and iterative, typically requiring post-tax modelling followed by back-solving to determine the corresponding pre-tax rate (Hayler, 2019). Second, the pre-tax approach may overlook the impact of the tax shield generated by depreciation in most tax jurisdictions. Third, pre-tax cash flows may misleadingly suggest that all cash flows are available to investors, disregarding the portion paid as corporate income tax.

Previous survey studies have predominantly found that most firms rely on after-tax cash flows in capital budgeting (Schall et al. 1978; Hodgkinson 1987; Kester et al. 1999; Zubairi 2008; Gul et al. 2018), although the proportion of firms that base their decisions on pre-tax cash flows remains considerable, ranging from 7% to 41%. There are also a few studies reporting that most respondents rely on pre-tax cash flows (Khamees et al. 2010), with reliance on pre-tax cash flows being more common among small and medium-sized enterprises (Alam & Stafford 1985). In the context of firm valuation, Kantšukov and Sander (2016) reported that among valuation professionals in Estonia, roughly half used pre-tax cash flows and half used post-tax cash flows. Survey evidence further indicates that firms typically do not account properly for the specific features of the local tax system (Truong et al. 2008) and do not use theoretically appropriate tax rates (Graham et al. 2017).

Although personal taxes have been shown to influence corporate investment decisions (Morellec & Schürhoff, 2007), there is a consensus that including personal taxes in capital budgeting is impractical due to unknown shareholder tax statuses, especially in progressive systems. The complexity of modelling personal taxes and their assumed reflection in market-based returns further justify excluding them when inputs come from consistent tax environments.

Finally, it is essential to recognize that tax systems and legislation vary significantly across jurisdictions. Therefore, any capital budgeting analysis must account for the specific legal and fiscal context of the country in which the investment is undertaken.

Choice of Discount Rate

While financial theory generally advocates the use of investment appraisal methods that incorporate the time value of money e.g. discounting of future cash flows, it offers no fully objective or precise procedure for establishing the appropriate discount rate (Markovics 2016). The selected rate should reflect, as accurately as possible, the specific attributes of the cash flows being discounted (such as their risk profile, timing, currency, and tax treatment), implying that the discount rate ought to be tailored to the project rather than derived solely from firm-level characteristics.

Companies typically assess prospective capital investment projects by comparing their expected returns with an internally determined hurdle rate, which represents the minimum return a project must achieve to be considered acceptable. In practice, these hurdle rates are often set substantially higher than the firm's weighted average cost of capital (WACC) and tend to remain relatively rigid over time. According to previous research, firms' hurdle rates typically exceed their WACC by an average of roughly 4% (Jagannathan et al. 2011; Brunzel et al. 2013; Graham and Harvey 2015) to about 7% (Meier and Tarhan 2007; Barry et al. 2024). This constitutes a conservative approach that, by creating a buffer, enables firms to accept projects whose NPV is substantially above zero. The rationale is that actual cash flows may turn out to be significantly lower than expected, meaning that the project might ultimately fail to break even; a higher discount rate provides a buffer that can offset this risk (Graham 2022). Jagannathan et al. (2011) also note that firms with strong growth characteristics are particularly inclined to use discount rates above the WACC, as they face substantially higher risk and possess numerous real-option opportunities.

Earlier survey evidence further indicates that hurdle rates are commonly based on the company-wide WACC rather than being project-specific, as recommended by financial theory (Bierman 1993, Bruner et al. 1998, Graham and Harvey 2002, Meier and Tarhan 2007). The use of WACC is theoretically appropriate when the risk profile of the investment project is broadly similar to that of the firm. Likewise, using the cost of equity as the discount rate may be consistent with financial theory when the discounted cash flows are defined from the perspective of equity holders.

Nevertheless, several studies, even in developed Western economies, have shown that theoretically inappropriate measures are sometimes used as the discount rate, including the cost of debt or the interest rate on bank loans (Schall et al., 1978; Arnold and Hatzopoulos, 2000; Hasan, 2013; Rossi, 2014). The use of cost of debt or interest rate on bank loans is even more widespread in developing countries (Verma et al., 2009, Mubashar, Tariq, 2019, Mollah et al., 2023).

A study conducted among Polish firms showed that a substantial proportion of companies use types of cost of capital that are not recommended by financial theory, including the marginal cost of capital (6%), the cost of debt (24%), and an arbitrary cost (14%) (Wnuk-Pel, 2014). In Central and Eastern Europe, however, a key problem is that many smaller firms do not estimate the cost of capital at all, because only a limited number of companies are publicly listed and deriving CAPM inputs from comparable firms is often difficult due to the scarcity of suitable listed peers (Andor et al., 2015). Unfortunately, without a discount rate, only the simplest methods - those that do not account for the time value of money - can be applied.

While the gap between capital budgeting theory and practice has narrowed considerably over the decades in large firms in Western countries, this is not the case for smaller firms in developed Western economies or for companies in Central and Eastern Europe. Many of these firms rely on overly simplified or even incorrect approaches, which can result in suboptimal investment decisions.

Sample and Data Collection

To compile the research sample, data from Äripäev's information database was used. A total of 1,466 public and private limited companies operating in Estonia were initially identified, each having a registered email address for either a Chief Financial Officer (CFO), Chief Executive Officer (CEO), or a member of the management board. Micro and small enterprises (defined as firms with fewer than 20 employees and annual turnover below €2.5 million in 2019) were excluded.

The survey was conducted in the first half of 2021 using the Google Forms platform. A total of 106 responses were received, resulting in a response rate of approximately 7.5%, which is comparable to several previous survey studies (see e.g. Baker et al 2011). Almost half of the respondents came from the manufacturing sector, and over 62% of respondents have been operating for more than 20 years (see table 1).

Table 1. Number of respondents by sector and firm age

Sector	Share of Respondents	Number of Respondents by Firm Age (years)				
		0-5	5-10	10-15	15-20	>20
Manufacturing	48,10%	4	2	4	9	32
Wholesale and Retail Trade	17,90%	1	2	1	1	14
Transportation and Storage	7,50%	1	1	1	2	3
Construction	6,60%	-	-	-	1	6
Information and Communication	6,60%	-	-	1	1	2
Others	13,20%	1	2	2	2	10
TOTAL		7	7	9	16	67
	100%	6,6%	6,0%	8,5%	15,1%	63,2%

Approximately 75% of respondents represent medium-sized enterprises, defined as companies with annual revenues between €10–50 million and 50–250 employees. Large firms (with revenues exceeding €50 million and more than 250 employees) account for 10.4% of the sample, while small firms (with revenues below €10 million and fewer than 50 employees) constitute 15%. Nearly 75% of respondents were part of a corporate group, either as a subsidiary (57 respondents) or a parent company (22 respondents).

The respondents were primarily CFOs, CEOs, and other senior executives. Over 70% belonged to either the management or supervisory board. More than 20% held ownership in the company they worked for. Regarding education, approximately 60% had a master's degree or higher, while over 25% held a bachelor's degree or applied higher education. The remaining respondents were either self-taught, currently pursuing higher education, or had incomplete studies. Nearly half of the respondents had worked in their company for more than 10 years. Over 80% were aged between 36 and 55 (see table 2).

Table 2. Respondent age and tenure in the company

Age Group	Respondents	Share (%)	Tenure length (years)			
			< 1	1-5	5-10	>10
26 - 35 years	6	6%	-	5	1	-
36 - 45 years	37	35%	-	10	12	15
46 - 55 years	51	48%	1	13	12	25
56 and older	12	11%	-	1	2	9
Total	106		1	29	27	49

Results and discussion

The initial focus of the study was to examine the extent to which capital budgeting is institutionalized and routinely practiced within companies. A substantial majority (98%) of respondents reported having undertaken capital investments within the past five years. Of these, 65% indicated that they perform some form of profitability and/or risk analysis for all investment decisions, whereas 35% acknowledged that such analyses are not conducted in every instance. Profitability analysis was most frequently omitted in cases involving the replacement of existing assets, small-scale investments, or investments deemed essential for the continuation of business operations (e.g., compliance with statutory requirements related to environmental protection or occupational safety). In certain cases, companies also refrained from conducting profitability analyses when the level of uncertainty was particularly high, such as in the context of launching new products or services. Notably,

approximately 5% of respondents stated that they do not conduct profitability analyses at all, relying instead on managerial intuition or performing only cursory evaluations.

Although 65% of respondents claimed to systematically assess the profitability of all investments, only 45% of companies reported having a formalized procedure accompanied by supporting documentation for conducting such analyses. These companies were predominantly part of corporate groups (79% of those with formal procedures and guidelines) and had operated in Estonia for more than 20 years. The relatively limited use of formal procedures and documentation may be attributable to the fact that investment decisions are often made at the owner or parent company level, or that smaller enterprises encounter such decisions infrequently, thereby reducing the incentive to develop standardized procedures.

While most companies (approximately 95%) conduct profitability analyses for at least some investments, a significant proportion (45%) do not base their investment decisions solely on the outcomes of these analyses. Instead, they also consider qualitative factors such as managerial intuition, strategic objectives of the company or its owners, financing opportunities, and the potential impact of the investment on environmental sustainability and occupational safety.

Subsequently, the survey explored which profitability methods are employed by companies and how frequently these methods are applied in investment evaluation. The survey was designed to allow differentiation between the methods used for evaluating large-scale versus small-scale investments³¹⁶. Over 60% of respondents reported that the methods applied to large-scale investments differ from those used for smaller projects. The following table presents the frequency of use of various methods in the evaluation of different size investments (see Table 3).

Table 3. Utilization Patterns of Investment Appraisal Methods in Large-Scale (L) and Small-Scale (S) Projects (%)

Method	Always		Almost always		Sometimes		Rarely		Ever	
	L	S	L	S	L	S	L	S	L	S
NPV	23,6	11,3	24,5	9,4	21,7	13,2	12,3	16,0	17,9	50,0
IRR	26,4	12,3	18,9	9,4	17,0	18,9	15,1	12,3	22,6	47,2
PB	55,7	34,0	27,4	37,7	6,6	7,5	5,7%	11,3	4,7	9,4
ARR	39,6	21,7	29,2	25,5	15,1	16,0	6,6	16,0	9,4	20,8
ROV	1,9	1,9	3,8	1,9	15,1	8,5	14,2	12,3	65,1	75,5

³¹⁶ The threshold for what constitutes a large-scale investment was left to the discretion of the respondent, as the sample included companies of varying sizes

According to financial theory, firms are expected to employ methods that account for the time value of money, such as Net Present Value (NPV), Internal Rate of Return (IRR), or Real Options Valuation (ROV). While most respondents (approximately 57%) reported using at least one of these recommended methods always or almost always, more than 70% employed, at least occasionally, methods considered theoretically inferior (e.g., payback period, accounting rate of return, or other simplified approaches) even in the evaluation of large-scale projects. It is also noteworthy that around 15% of respondents stated they never used any theoretically recommended methods when evaluating large-scale investments. In the case of small-scale investments, the reliance on simpler and theoretically inferior methods was even more prevalent. 85% of respondents relied at least occasionally on methods considered theoretically inferior or did not conduct any profitability analysis at all in the context of small-scale investments. Notably, 42% of companies reported never using NPV, IRR, or ROV for small-scale projects.

The survey also included a question regarding the most used method across all investment types within the company. More than half of the respondents identified the payback period as the most frequently applied method. This finding stands in clear contrast to financial theory, which advocates the use of NPV as the primary decision-making tool (or, in certain contexts, IRR or ROV).

Consistent with the findings of several prior studies (e.g., Graham & Harvey, 2001), the present study confirms that large firms utilize NPV and IRR methods for capital budgeting significantly more frequently than medium and small firms (according to Kruskal-Wallis's test). No statistically significant differences were observed between large, medium and small firms in the use of the Payback Period or Accounting Rate of Return methods. Other demographic characteristics of the company (sector, age) did not influence the choice of capital budgeting methods.

Subsequently, the study examined which indicator was used as the discount rate in investment evaluations (see Table 4).

Table 4. Types and Magnitudes of Discount Rates Used in Capital Budgeting

Discount rate applied by respondents in investment appraisals	Number of responses	Discount rate (%):					
		0-5	5,1-10	10,1-15	15,1-20	20,1-25	n.d
WACC	23	4	13	5	1	-	-
Average interest rate on bank loans	9	5	4	-	-	-	-
Owners' required rate of return	44	3	16	15	5	1	4
Expected return on alternative investments with comparable risk	12	1	4	2	2	-	3

Unable to specify / Don't know	18	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total	106	13	37	22	8	1	7

Financial theory suggests using either the cost of capital (WACC) or the expected return on an alternative investment with comparable risk as the discount rate. Approximately 39% of survey respondents adhered to this principle. Over 41% of respondents reported using the owners' required rate of return as the discount rate. This choice may also be consistent with theory, particularly in cases where the company does not utilize debt financing or where investment appraisal is based on cash flows to equity. However, using the average interest rate on bank loans as the discount rate (as reported by 8.5% of respondents) is clearly inconsistent with financial theory. Additionally, 17% of respondents were unable to specify which discount rate is used in their company. These were typically (but not always) companies that do not apply NPV, IRR, or real options methods in any investment appraisal, suggesting either the absence of formal profitability analysis or the use of methods that do not require discounting.

Financial theory posits that the discount rate should be adjusted to reflect the risk profile of the project. Therefore, the survey examined whether the 88 companies that reported using a discount rate adjust it based on project-specific risk factors. Responses were nearly evenly split: 51% of companies adjust the discount rate according to project risk, while 49% apply a single fixed rate regardless of project characteristics. This practice may result in overestimation of riskier projects and underestimation of less risky ones.

Among the companies surveyed, 63% used either the owners' required rate of return or WACC as the discount rate - both of which are influenced by the cost of equity. In half of these companies, the cost of equity was explicitly determined, while in the other half it was not. This suggests that the discount rate is often prescribed by the owner, and the company itself does not estimate its magnitude.

The choice of discount rates was also more aligned with theoretical recommendations in large companies. Compared to smaller firms, large companies used WACC approximately 3 times more frequently as the discount rate (about 55% of larger firms vs. approximately 18% of the small and medium firms), and none of the respondents from the large company group used the average bank loan interest rate as a discount rate.

The survey also investigated which types of cash flows companies consider in capital budgeting.

First, respondents were asked whether they base revenue and cost forecasts on nominal, real, or constant prices. Financial theory clearly recommends the use of nominal prices. 47% of respondents used nominal prices, 32% used real prices, and

21% used constant prices. Thus, one-fifth of respondents employed the simplest - but clearly incorrect - approach to cash flow estimation.

In response to the question, “*Does your company include costs (excluding the investment itself) incurred prior to the profitability analysis in the investment appraisal?*”, 26% answered that they always do so, and 41% indicated that they do so occasionally. Thus, at least two-thirds of companies consider sunk costs in their investment appraisals, which contradicts theoretical recommendations. Only one-third of respondents excluded such costs, which is the rational approach from a theoretical standpoint.

When asked, “*Does your company include in the cost calculation the revenues foregone as a result of approving the investment project?*”, 39% responded negatively, and an additional 34% stated that they do so occasionally. Therefore, more than 70% of respondents do not consistently account for opportunity costs in project evaluation. Only 27% provided a theoretically correct response, indicating that they always consider opportunity costs.

Considering the three preceding questions, only three companies out of 106 responded in a manner that was fully consistent with financial theory. The responses to the questions regarding the selection of cash flow types did not differ significantly across company size categories. It is evident that companies tend to adopt approaches that are simpler, rely on more easily defined inputs, and involve lower levels of uncertainty.

In response to the question, “*At what level are the cash flows for investment project profitability analysis calculated in your company?*”, over 80% of respondents stated that this is done on a pre-tax basis. This is clearly inconsistent with textbook recommendations. However, it must be acknowledged that Estonia’s corporate tax system differs significantly from those in most other countries. Companies (excluding banks) pay corporate income tax only when profits are distributed to owners, and dividends received by individuals are generally not included in taxable income - unlike interest income or realized capital gains. Therefore, applying textbook-based approaches may also lead to inaccurate results, and companies tend to prefer simpler methods in practice.

We also conducted an analysis to determine whether and how the demographic characteristics of respondents - namely, job position, age, level of education, and length of work experience within the observed company - affect their responses. The results indicated no statistically significant relationship between respondents’ age or tenure in the company and their answers. Furthermore, individuals holding master’s or doctoral degrees did not demonstrate a greater tendency to employ more advanced methods or to apply them in closer alignment with financial theory compared to those with a bachelor’s degree or those who identified as self-taught. This finding contrasts with several prior studies conducted in other countries (see Trahan and Gitman, 1995; Brounen et al., 2004 among others), and may be

attributable to the fact that the survey did not specify the exact field in which the respondents obtained their managerial education. Sarwary and Uman (2022) suggested that the educational background of a CFO may not play a significant role if they do not have broad discretion in making their decisions. Major investment decisions are generally made at the level of the supervisory board or ownership, rather than by the company's CFO or CEO.

However, responses did vary by job position. Financial managers exhibited a statistically significant higher usage rate of NPV and IRR methods, a preference for nominal pricing, and a tendency to adjust discount rates according to project-specific risk levels - indicating a stronger alignment with financial theory compared to respondents in other roles.

Conclusion

Financial theory provides well-established methodological guidelines for appraisal of investment projects, which have remained largely unchanged for several decades. However, survey-based research has consistently identified discrepancies between these theoretical prescriptions and firms' day-to-day practices. While the gap between theory and practice has narrowed considerably over time in large corporations in developed economies, it persists among smaller firms. Moreover, a substantial divergence between theoretical recommendations and practical application is evident among companies in Central and Eastern Europe.

This study examines capital budgeting practices in Estonian firms that are predominantly medium-sized. The survey results indicate that a significant proportion of respondents rely, at least in some cases, on inferior methods even when evaluating large-scale investments. This does not necessarily imply that reliance on payback period, ARR, or even managerial intuition will lead to poor decisions; however, the likelihood of suboptimal outcomes increases when companies depend on methods that may not yield rational decisions under certain conditions. The survey results further revealed that all formal profitability indicators were used less frequently in the evaluation of small-scale investments compared to large-scale projects. A substantial proportion of respondents consistently relied on theoretically inferior methods or refrained from using formal profitability indicators altogether.

As with method selection, the choice of discount rate also revealed a considerable number of companies that do not follow the recommendations of financial theory. Approximately one-quarter of respondents either did not use a discount rate or used one that can be considered theoretically inappropriate. Among those who did use a discount rate, half did not adjust it to reflect project-specific risk.

The level at which cash flows are used in capital budgeting (nominal versus real, pre-tax versus post-tax) and the factors considered when forecasting them in Estonian companies require further in-depth analysis, as the survey results indicate

that a significant proportion of Estonian firms do not conduct this analysis in the manner prescribed by financial theory.

The survey results indicate that the number of companies consistently applying theoretically correct methods in all situations is negligible. While this study does not allow for a definitive conclusion regarding whether the use of incorrect methods has led to irrational decisions, such a possibility clearly exists.

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SUMMARIES

ZUSAMMENFASSUNGEN

KOKKUVÕTTED

