Capital Budgeting Practices of the Fortune 1000: How Have Things Changed?

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Capital budgeting is one of the most important decisions that face the financial manager. Prior studies spanning the past four decades show financial managers prefer methods such as internal rate of return or non-discounted payback models over net present value, the model academics consider superior. This interesting anomaly has long been a puzzle to the academic community. A recent survey of the Fortune 1000 Chief Financial Officers finds net present value to be the most preferred tool over internal rate of return and all other capital budgeting tools. While most financial managers utilize multiple tools in the capital budgeting process, these results better reflect the alignment of the academic and business view.

Corporate capital budgeting and cost of capital estimation are among the most important decisions made by the financial manager. In this process, it is crucial that management use accurate methods that will result in the maximization of shareholder wealth. Over time, managers have used various commonly taught capital budgeting models and cost of capital estimations procedures; however, the use of models has not always aligned with what is taught in collegiate finance. This study re-examines the capital budgeting decision methods used by the Fortune 1000 companies. We show management views net present value (NPV) as the most preferred capital budgeting tool. Both NPV and internal rate of return (IRR) are superior to other capital budgeting tools, a result that represents alignment between corporate America and academia.

The paper proceeds as follows. The first part of the study provides a review of prior capital budgeting studies. The next section discusses the sample selection and survey methodology. We then present the results, followed by a concluding section.

REVIEW OF PRIOR CAPITAL BUDGETING STUDIES

Over the past four decades, financial research has recorded how businesses use capital management methods and how large corporations determine the cost of capital used in capital budgeting decisions. Financial managers and academics have not been in full agreement as to the choice of the best capital budgeting method. In Table 1, Miller (1960), Schall, Sundam, and Geijsbeek (1978), and Pike (1996) report payback technique as the most preferred method, while Istvan (1961) reports a preference for accounting rate of return. Early studies generally report discounted cash flow models to be the least popular capital budgeting methods. This might be attributed to the lack of financial sophistication and limited use of computer technology in that era. Mao (1970) and Schall et al. (1978) specifically point to NPV as the

least popular capital budgeting tool, a result in contrast to modern financial theory. Klammer (1972) reports a preference for general discounted cash flow models, and subsequently, the overwhelming majority of published research indicates that management prefers the use of internal rate of return (IRR) over all other capital budgeting methods.[1] Eight studies dating from 1970 to 1983 show profitability index, a ratio of present value and initial cost, to be the least most popular capital budgeting tool. Recently, Jog and Srivastava (1995) and Pike (1996) indicate a decreased acceptance of accounting rate of return in Canada and the United Kingdom, respectively.[2] Interestingly, throughout the literature, NPV has always trailed IRR in management preference. Managers have argued the perception of a percentage return is more easily understood and comparable than an absolute dollar value increase in shareholder wealth. Therefore, in the past, managers have chosen IRR over NPV. Evans and Forbes (1993) argue management views IRR as a more cognitively efficient measure of comparison. In a comparison of past studies, it is seen that managers are moving toward NPV as a method of choice, but never to the level of IRR.

Academics have long argued for the superiority of NPV over IRR for several reasons. First, NPV presents the expected change in shareholder wealth given a set of projected cash flows and a discount rate. For mutually exclusive projects, there is some dispute over the appropriate method. Second, when cash flows come in over a longer time period, NPV assumes the intermediate term cash flows are reinvested at the cost of capital. Internal rate of return, on the other hand, assumes the intermediate term cash flows are reinvested at the IRR, which for any positive NPV project is higher than the cost of capital.[3] Finally, NPV is not sensitive to multiple sign changes in cash flows. It is a method that presents the expected dollar amount that shareholder wealth would increase or decrease upon the acceptance of a project.

SAMPLE SELECTION PROCESS

The interpretation of survey data presents some limitations as discussed in Aggarwal (1980). While the survey was mailed to the CFO, the responses were the opinion of one individual and thus may not fully reflect the firm's position. It is possible this person may not be the best to assess the capital budgeting process if he/she is far removed from capital management. There is also potential concern about a non-response bias. In an attempt to limit this limitation, two personalized mailings were sent six weeks apart. While the survey technique is not without flaws, it has been generally accepted as a reasonable proxy given the time and personal constraints in large corporations.

A two-page questionnaire was mailed to the Chief Financial Officers (CFOs) of each of the Fortune 1000 companies. In an attempt to increase the response rate, each letter was personalized and signed. Furthermore, we mailed a copy of the results to interested respondents. Each survey was coded to avoid duplication in a second mailing.

Ten surveys were returned as undeliverable and thirty-two firms indicated they did not respond to mail surveys. Two hundred and five usable responses were received, for a response rate of 20.5%, which is comparable to similar surveys.[4] One hundred twenty responses were received from the first mailing and eighty-five from the second mailing.

TABLE 1
Comparative Results of Prior Studies*

Authors	Journal	Year Published	Population	Most Popular Capital Budgeting Tool	Least Popular Capital Budgeting Tool
Miller	NAA Bulletin (now Management Accounting)	1960	Fortune 500 & "Manual of Excellently Managed Companies"	PB	DCF
Istvan	Bureau of Business Research	1961	Selected large companies	AROR	DCF
Mao	Journal of Finance	1970	Selected large & medium companies	IRR	NPV & PI
Williams	Managerial Planning	1970	Fortune 500 & selected small companies	IRR	PI
Klammer	Journal of Business	1972	Compustat	DCF	PB
Fremgen	Management Accounting	1973	Dun and Bradstreet's Reference Book	IRR	PI
Brigham	Financial Management	1975	Selected financial managers	IRR	PI
Petry	Business Horizons	1975	Fortune 500 and Fortune 50 retailing, transportation & utilities	IRR	NPV
Petty, Scott, & Bird	Engineering Economist	1975	Fortune 500	IRR	PI
Gitman & Forrester	Financial Management	1977	Sample from Forbes	IRR	PI
Schall, Sundam, & Geijsbeek	Journal of Finance	1978	Compustat	PB	NPV
Oblak and Helm	Financial Management	1980	Fortune 500 MNC's in at least 12 countries	IRR	PI
Hendricks	Managerial Planning	1983	Some of Fortune 500	IRR	PI
Ross	Financial Management	1986	12 large manufacturers	IRR	PB
Jog & Srivastava	Financial Planning & Education	1995	582 Canadian companies	IRR	AROR
Pike	Journal of Business Finance & Accounting	1996	Large UK companies	PB	AROR

* The following abbreviations are used: Payback (PB), Internal Rate of Return (IRR), Net Present Value (NPV), Profitability Index (PI), and Accounting Rate of Return (AROR). The first 11 results were compiled from Scott and Petty (1984). DCF was used when specific discounted cash flow techniques were not enumerated.

RESULTS

Although all the firms are large, the size of the annual capital budget did vary among the respondents. The size of the capital budget is subdivided as follows:

Size of Capital Budget	Number	Percentage
Less than $50 million	35	17.1%
$50 - $99.9 million	42	20.5%
$100 - $499.9 million	78	38.0%
$500 - $1 billion	22	10.7%
Greater than $1 billion	28	13.7%
	205	100.0%

Next, the CFOs were asked at what level a formal capital budgeting analysis was required. As can be seen, 99.5% of the companies require a formal analysis; however, the minimum capital expenditure for the analysis varied substantially.

Amount of Capital Expenditure Required for Formal Capital Budgeting Analysis	Number	Percentage
Less than $10,000	42	21.2%
$10,000 - $99,999	54	27.3%
$100,000 - $500,000	63	31.8%
Greater than $500,000	38	19.2%
Never	1	0.5%
	198	100.0%

Use of Basic Capital Budgeting Methods

Respondents were asked how frequently they used seven capital budgeting methods: net present value, profitability index, internal rate of return, modified internal rate of return, payback, discounted payback, and accounting rate of return. The responses were on a five point Likert scale with the following percentages attached to each alternative in an attempt to quantify the responses: "always" (100%), "often" (approximately 75%), "sometimes" (approximately 50%), "rarely" (approximately 25%), and "never" (0%).

In Table 2, it is seen that NPV was always utilized by 49.8% of the respondents and frequently (always and often combined) used by 85.1% of the respondents. Finally, when including the "sometimes" category, the cumulative use of NPV climbs to 96% of the firms. Net present value gains the highest positive response in comparison to other basic capital budgeting techniques. Internal rate of return was always used by 44.6% of the firms, and frequently (always and sometimes combined) used by 76.7% of the respondents. Finally, when including the "sometimes" category, the usage rates increase to 92.1% of all respondents. The results show that NPV and IRR are preferred over all other capital budgeting methods. This is a notable alignment of theory and practice.

The size of the capital budget is a significant factor in the choice of capital budgeting methodology. Within NPV, the Pearson Chi-squared test of independence is significant at

TABLE 2
Comparison of Basic Capital Budgeting Tools

Capital Budgeting Tool (level of technical difficulty) L=Low, M=Medium, H=High	Size of Capital Budget (in millions)	Always (100%)	Often (75%)	Sometimes (50%)	Rarely (25%)	Never (0%)	Always or Often (>=75%)	Always, Often, or Sometimes (>=50%)	Rarely or Never (<=25%)
Net Present Value (NPV) *** (L)	Less than $100	32.9%	52.6%	13.2%	1.3%	0.0%	85.5%	98.7%	1.3%
	$100 - $499.9	56.0%	25.3%	10.7%	5.3%	2.7%	81.3%	92.0%	8.0%
	Greater than $500	67.3%	22.5%	8.2%	2.0%	0.0%	89.8%	98.0%	2.0%
	Full Sample	49.8%	35.3%	10.9%	3.0%	1.0%	85.1%	96.0%	4.0%
Internal Rate of Return (IRR) **(L)	Less than $100	30.3%	43.4%	21.1%	3.9%	1.3%	73.7%	94.8%	5.2%
	$100 - $499.9	49.3%	25.3%	12.0%	12.0%	1.4%	74.6%	86.6%	13.4%
	Greater than $500	60.0%	24.0%	12.0%	2.0%	2.0%	84.0%	96.0%	4.0%
	Full Sample	44.6%	32.2%	15.3%	6.4%	1.5%	76.7%	92.1%	7.9%
Payback ** (L)	Less than $100	26.0%	37.7%	20.8%	13.0%	2.5%	63.7%	84.5%	15.5%
	$100 - $499.9	14.1%	33.8%	22.5%	12.7%	16.9%	47.9%	70.4%	29.6%
	Greater than $500	17.0%	25.5%	23.4%	27.7%	6.4%	42.5%	65.9%	34.1%
	Full Sample	19.4%	33.2%	21.9%	16.8%	8.7%	52.6%	74.5%	25.5%
Discounted Payback (L)	Less than $100	17.6%	28.3%	20.3%	20.3%	13.5%	45.9%	66.2%	33.8%
	$100 - $499.9	11.3%	18.3%	23.9%	22.6%	23.9%	29.6%	53.5%	46.5%
	Greater than $500	18.8%	18.8%	10.4%	20.8%	31.2%	37.6%	48.0%	52.0%
	Full Sample	15.5%	22.2%	19.1%	21.1%	22.2%	37.6%	56.7%	43.3%
Profitability Index* (L)	Less than $100	2.8%	22.2%	25.0%	20.8%	29.2%	25.0%	50.0%	50.0%
	$100 - $499.9	11.4%	14.3%	17.1%	18.6%	38.6%	25.7%	42.8%	57.2%
	Greater than $500	2.3%	6.8%	27.3%	29.5%	34.1%	9.1%	36.4%	63.6%
	Full Sample	5.9%	15.5%	22.5%	21.9%	34.2%	21.4%	43.9%	56.1%
Accounting Rate of Return * (L)	Less than $100	8.2%	5.5%	24.6%	9.6%	52.1%	13.7%	38.3%	61.7%
	$100 - $499.9	1.4%	12.7%	11.3%	23.9%	50.7%	14.1%	25.4%	74.6%
	Greater than $500	6.8%	11.4%	20.4%	15.9%	45.5%	18.2%	38.6%	61.4%
	Full Sample	5.3%	9.5%	18.5%	16.4%	50.3%	14.7%	33.3%	66.7%
Modified IRR * (M)	Less than $100	0.0%	4.2%	14.1%	25.4%	56.3%	4.2%	18.3%	81.7%
	$100 - $499.9	1.5%	13.2%	13.2%	28.0%	44.1%	14.7%	27.9%	72.1%
	Greater than $500	7.0%	2.3%	9.3%	32.6%	48.8%	9.3%	18.6%	81.4%
	Full Sample	2.2%	7.1%	12.6%	27.9%	50.3%	9.3%	21.9%	78.1%

Response to the question, "Please classify how frequently your firm utilizes each of the following budgeting tools. "Often" would generally mean that you use this tool about 75% of the time, "sometimes" would refer to about 50%, and "rarely" would mean about 25% of the time." The absolute percentages are in columns 3-7 and the cumulative percentages are in columns 8-10. Results are based on 205 responses by size of capital budget. All tools can be completed with basic Excel or other spreadsheet functions.

where *** is χ^2 significant within the specific capital budgeting method at the .01 level,
** is χ^2 significant within the specific capital budgeting method at the .05 level, and
* is χ^2 significant within the specific capital budgeting method at the .10 level.

TABLE 3
Relative Usage of Various Supplementary Capital Budgeting Tools

Supplemental Capital Budgeting Tools (level of technical difficulty) L=Low, M=Medium, H=High	Always (100%)	Often (75%)	Sometimes (50%)	Rarely (25%)	Never (0%)	Always or Often (>=75%)	Always, Often, or Sometimes (>=50%)	Rarely or Never (<=25%)
Sensitivity Analysis (M)	20.5%	44.6%	20.0%	4.1%	10.8%	65.1%	85.1%	14.9%
Scenario Analysis (M)	10.5%	31.1%	25.3%	12.1%	21.1%	41.6%	66.8%	33.2%
Inflation Adjusted Cash Flows (M)	12.0%	19.4%	15.2%	25.1%	28.3%	31.4%	46.6%	53.4%
Economic Value Added (EVA) (M)	12.0%	18.8%	23.0%	19.9%	26.2%	30.9%	53.9%	46.1%
Incremental IRR (M)	8.5%	19.1%	19.7%	16.5%	50.3%	27.7%	47.3%	52.7%
Simulation (H)	3.1%	16.2%	17.8%	27.2%	35.6%	19.4%	37.2%	62.8%
Market Value Added (MVA) (M)	3.7%	11.2%	18.1%	26.6%	40.4%	14.9%	33.0%	67.0%
PERT/CPM (M)	1.1%	7.1%	22.8%	26.1%	42.9%	8.2%	31.0%	69.0%
Decision Tree (M)	1.1%	6.8%	23.2%	33.7%	35.3%	7.9%	31.1%	68.9%
Complex mathematical models (H)	1.1%	6.5%	13.5%	22.2%	56.8%	7.6%	21.1%	78.9%
Linear Programming (H)	0.0%	5.4%	11.4%	23.2%	60.0%	5.4%	16.8%	83.2%
Option Pricing Model (H)	0.0%	5.3%	15.5%	26.7%	52.4%	5.3%	20.9%	79.1%
Real Options (H)	0.5%	1.1%	9.7%	23.2%	65.4%	1.6%	11.4%	88.6%

Response to the question: 'Please classify how frequently your firm utilizes each of the following budgeting tools. "Often" would generally mean that you use this tool about 75% of the time, "Sometimes" would refer to about 50%, and "rarely" would mean about 25% of the time.' The absolute percentages are in columns 2-6 and the cumulative percentages are in columns 7-9. Results are based on 205 responses. All models can be constructed in Excel or similar spreadsheets with embedded macros for the more advanced models.

Brief description of supplementary capital budgeting tools:

- Sensitivity analysis allows for the change in one input variable at a time, such as sales or cost of capital, to see the change in NPV.
- Scenario analysis allows for the change in more than one variable at a time, including probabilities of such changes, to see the change in NPV.
- Inflation Adjusted Cash Flows adjusts expected future cash flows by an estimated inflation factor.
- Economic Value Added (EVA) measures managerial effectiveness in a given year or period (net operating profit after taxes – after tax cost of capital required to support operations)
- Incremental IRR is the IRR of the difference in cash flows of two comparison projects; commonly used in replacement decisions
- Simulation is a method for calculating the probability distribution of possible outcomes.
- Market Value Added (MVA) is the market value of equity – equity capital supplied by shareholders.
- PERT/CPM is the analysis and mapping of the most efficient financial decision.
- Decision trees are graphical illustrations used to model a series of sequential outcomes, along with their associated probabilities.
- Complex mathematical models is a general term inclusive of various option pricing model techniques, complex real options, and firm specific proprietary models and methods.
- Linear programming identifies a set of projects that maximizes NPV subject to constraints (such as maximum available resources)
- Option pricing model include either binomial option pricing model or the Black-Scholes option pricing model, the latter used by firms such as Merck with high R&D expenditures and relatively few, albeit large positive NPV investments.
- Real options include the opportunity for expansion, contraction, or abandonment of a capital project before the end of its life.

the 1% level; within IRR, it is significant at the 5% level.[5] This indicates a positive relationship between the size of the capital budget and the use of NPV and IRR. Similar analyses were performed based on the size of the capital expenditure. The results are qualitatively similar.

The third model was the payback, a favorite of business in the 1960s and used at least half of the time by 74.5% of the respondents. Fourth in popularity was the discounted payback model, used at least half of the time by 56.7% of the companies. Finally, at least half-time usage was reported for the last three models as follows: profitability index ranks fifth at 43.9%, followed by accounting rate of return at 33.3% and finally, modified internal rate of return (MIRR) at 21.9%. Examination of within model proportions for profitability index, accounting rate of return, and modified internal rate of return reflect chi-squared significance at the 1% level, while the proportion distributions for payback are chi-squared significant at the 5% level. The only model that is not chi-squared significant when subdivided by the size of the capital budget is discounted payback. Payback and profitability index are more frequently used by firms with smaller capital budgets, while modified internal rate of return appears to be used more frequently by firms with capital budgets in the range of $100-$500 million.

Modified internal rate of return is the least popular of all discounted and non-discounted models. Some argue MIRR is superior to IRR because it allows the manager to adjust the discount rate of intermediate term cash flows to better match a realistic return for the cash flows. Samuel C. Weaver, Director of Financial Planning and Analysis of Hershey Foods, commented at the 1988 FMA meeting (Financial Management Panel Discussion; 1989):

> [M]odified internal rate of return... is a subject that is thinly written about. [In his discussion, he referred to modified IRR as terminal IRR] Terminal internal rate of return will always give an answer that is consistent with net present value, as long as the reinvestment rate is identical to the discount rate that would have been used for net present value...[MIRR] gives the right answer and in such a way that management can understand it as a rate of return.

Given strong theoretical support and the inclusion of MIRR in popular financial spreadsheet packages, it may appear surprising that MIRR has garnered so little acceptance from the CFOs in this study. It is possible MIRR will gain acceptance in the delayed manner that NPV gained acceptance over a period of several decades. If this is to be the case, we may see a surge in MIRR applications over the next decade as more financial managers work with this technique especially if the reinvestment rate argument is valid.[6]

Use of Advanced Capital Budgeting Methods

The same format was used to ask about the use of more specialized methods. In Table 3, it is shown that sensitivity analysis was the most popular tool, followed by scenario analysis. Inflation adjusted cash flows were used by 46.6% of the responding firms on a regular basis.

Stern Stewart's Economic Value Added (EVA®) and Market Value Added (MVA®) models receive strong acceptance and use despite the relative youth of the methods. Stern Stewart argues that EVA is the financial performance measure that comes closer than any other to

capturing the economic profit of an enterprise. They define EVA as the difference between a firm's net operating after tax income and the cost of capital while MVA is a cumulative measure of wealth creation. EVA was used by over half of the respondents while MVA was used by approximately one third.

Incremental IRRs were used by 47.3% of the respondents, while simulation models were used by 37.2%. PERT/CPM charting and decision trees were each used by about 31% of the firms. From this point, the more complex mathematical models, such as linear programming and option models, receive less corporate acceptance.

Management Determination of Appropriate Cost of Capital

Several studies examine the cost of capital for large firms (Gitman & Mercurio, 1982; Jog & Srivastava, 1995; Oblak & Helm, 1980) and other studies examine the approximate cost of capital facing large companies (Schall et al., 1978; Gitman & Forrester, 1977). Oblak and Helm (1980) examine the cost of capital practices of multinationals and found weighted average cost of capital (WACC) was used by 54% of the respondents. Other measures cited in their study include the cost of debt, past experience, expected growth rate, and CAPM. Jog and Srivastava (1995) found WACC to be used by 47% of Canadian firms, but significant numbers of firms also use the other measures found in Oblak and Helm (1980).

In academia, it is argued that WACC is the superior base level for cost of capital determinations. The following closed ended question was posed: "In general, which of the following does your company consider to be the best discount rate?" The vast majority (83.2%) chose WACC, while 7.4% chose the cost of debt, 1.5% chose the cost of retained earnings, and 1.0% chose the cost of new equity. A minority (5.4%) chose cost of equity for a project financed with equity and cost of debt for a project financed with debt and 1.5% indicated they had another measure for calculating the base discount rate. The results indicate that WACC was the strong preference among the respondents, in alignment with academia.

CONCLUSION AND IMPLICATIONS

It appears the views of academics and senior financial managers of Fortune 1000 companies on basic capital budgeting techniques are in stronger agreement than ever before. Discounted capital budgeting methods are generally preferred over non-discounted techniques. While it is possible the survey results reflect the increased financial sophistication and availability of inexpensive computer technology, it was shown that net present value is the most frequently cited capital budgeting tool of choice, followed closely by IRR. Additionally, firms with larger capital budgets tend to favor NPV and IRR. The vast majority of respondents agree that WACC is the best starting point to determine the appropriate discount rate. Popular supplemental methods include sensitivity analysis, scenario analysis, inflation adjusted cash flows, economic value added, and incremental IRR. It will be interesting to track the progression of MIRR over the next decade to see if this technique gains more acceptance, especially for those firms with large capital budgets.

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ENDNOTES

[1] See Williams, 1970; Fremgen, 1973; Brigham, 1975; Petry, 1975; Petty, Scott, and Bird, 1975; Gitman and Forrester, 1977; Oblak and Helm, Jr., 1980; Hendricks, 1983; Ross, 1986.

[2] In a recent multinational study of the Asia-Pacific, Kester et al. (1999) found internal rate of return and net present value the most popular capital budgeting tools for large companies in that region.

[3] Brealey and Myers (1995) dispute this point and argue the reinvestment rate assumptions are not essential to evaluating a given project since reinvestment rates represent the return on another, separate project.

[4] For example, Jog and Srivastava (1995) have a response rate of 22.9%; Trahan and Gitman (1995), 12%; Gitman and Maxwell (1985), 23.6%; and Poterba and Summers (1995), 26.3%.

[5] The Pearson Chi-squared test of independence is frequently used to test for differences in proportions between two or more groups. The Chi-squared test is used to see if grouped data fit into declared groups. Rejection indicates the data do not fit into the group. The statistical tests were performed in Excel.

[6] If, as posited by Brealey and Myers (1995), the assumption of reinvestment rates is not required, modified internal rate of return may not gain additional support.