ECON 400 ECON 448

CAPITAL BUDGETING

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1 - CAPITAL BUDGETING

1.1 - MEANING AND IMPORTANCE OF CAPITAL BUDGETING

Every year, firms or businesses invest hundreds of billions of dollars in new fixed assets - plant, equipment, pollution control devices, cars, trucks, and storage facilities. Unlike current assets, which have a short life, these longer-term investments in fixed assets involve cash outlays that are expected to result in benefits to the firm over several years. Such expenditures are classified as Capital Expenditures. The Capital Expenditures are usually used to obtain Capital assets which are used by the company in the actual production of goods and services. These assets are extremely important to the firm because in general, <u>nearly all of its capital investments</u>; these assets represent very large commitments of resources; and the funds will usually remain invested over a long period of time.

Generally the money volume involved in acquiring these Capital assets is very large, and the firms must plan carefully before commiting scarce resources to them. The plans for Capital Expenditures are summarized in a <u>CAPITAL BUDGET</u>. Capital Budget concentrate on the benefits and costs of projects and the decisions made determine the composition of total assets and the business-risk complexition of the enterprise.It is future oriented and shapes operating plans for several years in to the future.

The future development of the firm hinges on the selection of Capital investment projects , the decision to replace existing Capital assets , and the decision to abandon previously accepted undertakings which turn out to be less attractive to the firm than was originally thought.

The process of determining exactly which asset to invest in or in other words, and in a more general sense, in which Capital investment project to invest and how much to invest is called <u>CAPITAL BUDGETING</u>.

The Capital Budgeting decision is a complex process that involves several activities, and is very important for a firm. Capital Budgeting decision are made frequently within a business organisation, and these decision exert considerable influence on the profitability of the company as well as on the company's stock price.

The management must always be on the alert to explore different kinds of opportunities faced by the firm. The installment of new technological equipment may lead to an increase and bring efficiency to the production line. Changing consumer tastes on the other hand may create increases in the demand for existing products or may create demand for entirely different products. Merger with other firms enable the company to strengthen its competitiveness within the market place among other competitors.

One other crucial importance of Capital Budgeting to a firm is that the irreversability of the major Capital investment projects.For that the specilized type of machinery being installed has a very small second hand value if the firm reverses its decision.

In short, Capital Budgeting is used for every investment project that would result in costs and reverces over a number of years.

In general firms classify investment projects in to several categories ;

i) <u>REPLACEMENT</u>: Investment to replace the worn out equipment in the production process.

This is the easiest decision to make since the management is familiar with the specifications, productivity, and operating and maintenance costs of existing equipment and with the time when it needs to be replaced.

ii) COST REDUCTION: Investment to replace working but inefficient equipment with new and more efficent equipment, expenditures made to reduce labor costs by training programs, and expenditures to move production facilities to areas where factors of production like labor and other inputs are cheaper.

This is a more complex and usually require more detailed analysis and approval by the higher-level management.

iii)OUTPUT EXPANSION OF TRADITIONAL PRODUCTS AND MARKETS: Investments to increase the production of the firms tradional products in traditional or existing markets in response to increased demand.

This is more complex and detailed analysis and approval by the higher level management requiring, however familiarity with the product and the market usually does not make these projects among the most challenging that the management is likely to face.

iv)EXPANSION INTO NEW PRODUCTS AND/OR MARKETS: Investment to develop, produce and sell new products and/or to enter into new markets.

This is a very complex and is the riskiest amongst all. Although they are the most essential and financially rewarding in the long run since a firm's product line tends to become obsolete overtime and its traditional market may shrink or even disappear.

v)GOVERNMENT REGULATION: Investments to meet the governments rules and regulations.

The government regulations often give rise to special legal, evaluation, and monitoring problems requiring outside expert assistance.

While the final decision to undertake or not to undertake a major investment project is rested by the top management, in well managed and dynamic firms all employees are encouraged to come up with new investment ideas. This is because of the crutiality of the new investment projects to the future profitability and the very survival of the firm overtime.

research and development Most large firms have special divisions, especialy entrusted with the responsibility of coming up with proposals for new investment projects. These divisions are to work in great cooperation with all other divisions of the firm and are staffed by experts in product development marketing research and industrial engineering and so on.

1.2 OVERVIEW OF THE CAPITAL BUDGETING PROCESS:

A firm should produce the output or undertake an activity until the marginal revenue from the output or activity is equal its marginal cost CAPITAL BUDGETING is an essential to application of this general principle.

This implies that the firm should undertake additional investment projects until the marginal return from the investment is equal to its marginal cost.

Firms demand for capital is represented by the schedule of various investment projects open to the firm arranged from the the one with the highest to the lowest return.

On the other hand, marginal cost of capital (2..) schedule gives the cost that the firm faces in obtaining additional amounts of capital for investment purposes. The intersection of the demand and marginal cost curves for capital that the firm faces, determines how much the firm will invest.



The various lettered bars indicate the amount of capital required for each investment project. The top of each bar represents the firms demand for capital. Note that the projects are arranged from the one that is expected to generate the highest rate of return to the one that is expected to provide the lowest return.

The marginal cost of the capital (MCC) curve shows that the firm can rate about \$2 million of capital at the (cost) of 10 percent, but if it wants to raise additional amounts, it faces increasingly higher costs.

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2 - THE CAPITAL BUDGETING PROCESS

The Capital Budgeting process involves several activities, and the entire process may be viewed conventioanly in terms of six phases. In some companies, the various are done on a companywide basis by a centralized planning group that performs the capital budgeting analysis. In other firms it is done at a divisional level.

Managers must determine their long term goals, identify prospective investment proposals, evaluale the profitability of those proposals, implement and control the projects accepted, and upon completion of a project, evaluale its success or failure.

2.1 - STEPS IN EVALUATING INVESTMENT DECISIONS

a) IDENTIFYING THE IMPACT ON LONG-TERM GOALS:

The first step is to formulate long-term goals. The firms ultimate objetctive is to maximize the stock price and, consequenctly, the share holders wealth, regardless of the project being considered.

Although the overriding objective does not change from project to project. Many projects cannot be completely evaluated in terms of their impact on stock price.

The decision of a firm to spend millions of dollars on environmental improvement for example, may lower its profits and cash flows in the short-run. However management might feel that it is consistent with another long term goals of the companybeing of service to the community, or meeting governmental rules and regulations.

Thus intangible benefits that are consistent with the firms long term goals should be identified with each project, and these benefits and costs should be considered together with other economic analyses. These intangible benefits are often called strategic considerations. Strategic consideretaions can also be time related or marketing related.

These decisions are extremely difficult to make because they involve a variety of factors that simply cannot be generalized.

b)SCREENING:

Before an objective analysis can be performed, the company must identify potential investment proposals. These proposals can originate in a variety of ways. Large companies have project analysis divisions that actively search for new ideas, projects and ventures. Divisional managers and product managers usually take their proposals to a planning committee or even to the board of directors. Managers use the input from a variety of sources; engineers, market analysts, sales personnel and so on, virtually every employee of the company is a potential source of ideas, and many companies encourage their employees to develop new concepts for evaluation by the investment division.

Management must first evaluate its ability to exploit the

investment opportunities in qualitative terms, and gauge the potential impact of these investments on the firms revenues and costs. If a proposal passes this initial screening, it is subject to more detailed analysis.

In this screening phase the potential proposals can be categorized into three groups.

i)COST REDUCTION PROPOSALS:

Lower the firms operating costs if accepted. A firm may choose to replace its worne out or iffecient machinery with new ones that consume less energy.Replacing the old machinery in this case would be a <u>cost-reduction proposal</u>.

ii) VERTICAL REVENUE EXPENSION PROPOSALS:

Increases the revenues of the company if output is increased. A company producing 5000 units of product doubles its output to 10000 units of finished product.

iii)HORIZONTAL REVENUE EXPANSION PROPOSALS:

Proposals that are unrelated to the company's existing activity. For example a small printing company plans to invest in REAL ESTATE.

Proposals in each category are characterized by similar objectives and operating characteristics. Classifying proposals into these categories simplifies the analysis and enables management to screen out and to eliminate certain proposals for feasibility in qualitative considerations.

c) EVALUATION:

Estimating the cash flows from the various proposals, identifying projects, and applying objective ciriteria before making an accept / reject decision, are the three distinct activities that consists the evaluation phase.

A proposals is any idea under consideration.

A plan to introduce new product line, a plan to cease credit sales, a plan to buy a vineyard, discussions on increasing the advertising budget are all capital budgeting proposals. Several of many proposals that are considered by a firm, may be related to one another in terms of after tax cash flows(CFAT). To identify and properly handle all of these related cash flows in the capital budgeting process is important. So all proposals whose cash flows are economically dependent on one another must be evaluated together as a project.

A project is either a single proposal or a collection of dependent proposals that is economically independent of all other proposals.

PROPOSALS AND PROJECT WHY DISTINGUISH IN BETWEEN ?

To group proposals into projects for capital budgeting analysis is easy to understand.

EX: A softdrink company manufacturing a cola drink plans to introduce a new orange drink(a new proposal). Based on casual capital budgeting analysis, management has decided that the orange drink (proposal) will be a good addition to the firm as it will increase the value of the company's equity.

Although it is tempting to conclude that management schould accept this new proposal, a little reflection will suggest that this is true only if acceptance does not affect the cash flows of other projects. If, for example, management has to channel the advertising cash it has set aside for the cola market into the orange drink's advertising budget, the sales and consequently the cash flows from the cola drink can fall.

In this case, while the cash flows from the orange drink can increase the wealth of the share holders, the decreased sales of the cola drink can lower it. Thus it is not clear that the orange drink proposal is a good idea. The cola and the orange drink should be evaluated together as a project. Only if the cash flows from the orange drink have no impact on the cash flows from the cola project would management be justified in accepting the orange drink without worrying about its impact on the cola market.

Thus it is important to group all proposals with cash flow dependencies together into a project and then subject the projec to capital budgeting analysis.

COMPLEMENTARY PROPOSALS:

X and Y are complementary proposals if that the acceptance of increases the cash flow from proposal Y. So, X and Y complementary proposals if the cash flows from these projects together exceed the sum of the cash flows that would be generated from either project individually.

SUBSTITUTE PROPOSALS:

X and Y are substitutes, if the acceptance of proposals X reduces the cash flows from proposal Y. That is, the cash flows from taking on two substitute proposals are less than the sum of the cash flows generated by the two projects individually.

INDEPENDENT PROPOSALS:

X and Y are independent proposals, if the acceptance of proposal X has no effect whatsoever on the cash flows of proposal Y. In this case, the cash flows are additive; there is neither a gain nor a loss in cash flows from accepting both X and Y.

d) IMPLEMENTATION:

The required arrangements being made to take on the new project the next step is the implementation phase. First of all the company should make sure that it has readily available enough capital that is required to get the project started. This initial startup capital, usually called the capital outlay, is assumed to be raised by the firm without serious problems leading the implementation phase being fairly straight forward. The firm then can proceed with the necessary changes to get the project going.

e) CONTROL:

The firm must monitor the costs and revenues generated by the project constantly after the implementation of the project, and assess the extent to which the actual figures deviate from the values that are forecasted while used in making the capital budgeting decision.

This brings several advantages with it;

- -Any unnecesary inefficiencies can easily be corrected. If some cash flow figures deviate drastically from planned(projected values), this could result from several things.
- -The forecast might have been bad, and the firm can learn from this experience and correct for potential forecast errors in future capital budgeting decision.
- -The forecast might have been good, but unpredictable events (war,tax-law charges etc.) might have changed the situation drastically, and the firm might have no way of controlling the new cash flows.

Whatsoever, by observing the differences between planned or forecasted and the actual cash flows, the firm gains valuable experience that it can apply them to future capital investment analyses.

f)AUDIT:

Often called the post completion audit, the audit phase is the one stage of capital budgeting that is often ignored. This phase is not a part of the capital budgeting decision process rather it is a follow-up and review stage to identity the succes or failure of the completed projects and an attempt to identify the reasons for this success or failure.

In this matter this phase, like the control phase provides valuable information for the firm, about the things done right and wrong, and may be hold a light for the areas that needs to be more constantly concerned by the firm in the forthcoming projects.

3) PROJECTING CASH FLOWS

The difference between cash receipts and cash expenditires over the life of a project, in other words, <u>net cash flow from a</u> <u>project</u> is a difficult and that much important aspect of the capital budgeting. Uncertainty is inevitable since these cash receipts and expenditures are to occur in the future.

Periodic cash outflows and inflows that occur if and only if an investment project is accepted are called the <u>Incremental</u> <u>Cash Flows After Taxes(ACFAT)</u>. These are the only relevant cash flows in capital budgeting.

INCREMENTAL

-Only those cash flows affecting the firms existing cash flows should be considered. For decision making purposes the only relevant cash flows are the changes in the flow of revenues, expenses, and taxes caused by a project's acceptance.

The idea of sunk costs is an important concept for the determination of incremental cash flows.

Sunk costs are irrelevant to include into the analysis. Why ? Managers, in making economically justifiable decisions must focus only on, inflows and outflows that will exist only if the decision is adopted, i.e.incremental cash flows. All other costs are irrelevant, and it is a mistake to include sunk or historical costs into the analysis.

"It's no use crying over spilled milk" saying, is the most appropriate in capital budgeting. So, if a sum of money is already spent, it cannot be affected by your decision. Efforts should be devoted to examine those cash flows that will only be affected by the decision. Determining the best course of action is based only on the incremental cash flows.

CASH FLOW:

-Rather than accounting income and expenses, the relevant measure of dollar benefits is the cash flow. Cash flows are generally not the same as income or profits. Deducting current expenses to calculate profits and recognizing expenses when they are incurred instead of when they are paid are two different accounting techniques.

So, an increase in after-tax expenses does not necessarily translate into cash outflows. The initial cost of an asset is depreciated over it's useful life for accounting purposes, which will yield different sets of income figures for the same investment just by changing the depreciation methods.

A cash flow analysis would take into account the first year an initial \$100,000 outlay for an asset. An accountant ,on the otherhand, would spread the cost over the machine's depreciable life.Both of these two approaches would clearly produce different results and are equivalent only if the discount rate is zerowhich is a most unlikely situation.

AFTER-TAX:

-For several reasons all cash flows must be estimated consistently on an after-tax basis.

1) The initial cash flows are normally investment outlays of after-tax dollars.

2) Most investments affect a firm's tax payments.

The incremental cash flows, the revenues and expenses that will be generated by a new project are first determined without any tax consideration.Then taxes are estimated and deducted to produce cash flow after taxes.

3.1 CLASSIFICATION OF CASH FLOW AFTER TAX

The number of different cash flow can be large, in analyzing cash flows.We break up the periodic-usually annual-stream of expenses and benefits into three groups, we will now go into detail the categories which are;

- 1. Initial CFAT
- 2. Operating CFAT
- 3. Terminal CFAT

1. INITIAL CASH FLOWS:

Initial investments are expenditures which occur when the project begins which include expenditures to acquire property, plant and equipment.Cash flows, within this category can conventionally be divided into;

DIRECT CASH FLOWS INDIRECT CASH FLOWS Capital expenditures After-tax proceed of old assets sold Operating expenditures Change in net working capital

A particular investment proposal may involve a few or all of these types of cash flows.

DIRECT CASH FLOWS:All cash expenditures for the acquisition of an asset must be classified either as capital or operating expenditures for accounting purposes.

Distinction between Capital and Operating Expenditures.

<u>Cpital Expenditures</u> are those cash outflows that are expected to produce future benefits extending beyong one year.

They are treated as an asset on the balanc sheet.Other expenditures other than the purchase price may also be incurred to make an asset operational.Expenses like freight, preparation or installation costs, removal of old asset or building modifications are properly treated as part of the asset's cost.These all are together form up the gross investment for depreciation purposes.

Operating Expenditures are those expenditures or cash outlays that privideno benefits beyond the current period.

These are charged against current revenues rather than being treated as an asset on the balance sheet.So these do not become part of an investment's depreciation base.Because these outlays part of an investment's depreciation base.Because these outlays are tax deductable, the true expenditure is less because the firm, in effect, gets a rebate from the government.

Thus;

After-tax cost=(before-tax cost)x(1-tax rate)

i.e. the after-tax or effective cost of a tax-deductable item is the before-tax cost multiplied by (1-T), where T is the firm's marginal tax rate in percent.

INDIRECT CASH FLOWS: Tax considerations become important whenever an older asset is sold, to be replaced by a new asset. The company may pay taxes or may be entitled to a tax credit depending on whether there is a gain or loss, any time an asset is sold. These tax considerations affect the cash flows from the project and must be recognized in any capital budgeting decision. Two cases are possible in relationship between Market Value (MV) and the Book Value (BV) of an asset.

CASE 1: MV<BV ---> The firm has a loss, which will be subsidized by the tax code.

CASE 2: MV>BV ---> The firm has a taxable profit.

2. OPERATING CASH FLOWS

An appropriate capital budgeting analysis, requires that the investment and financial decisions be separated.Managers should evaluate the project without explicit recognition of the manner in which the capital to finance the project is being raised. Interest payments on debt should not be included in the computation of a project's cash flows.The cost of debt will enter indirectly via the Required Rate of Return (RRR) used to discount these cash flows.

The cash flows generated by an asset discounted at the appropriate RRR is the value of an asset. The Cash Flows generated by an asset are the operating cash flows, which is independent from the amount of debt or interest payments being made by the company.

The operating cash flows in contrast to the initial investment cash flows, represent the net benefits (incremental cash flows after taxes) received over a project's economic life. Once the estimates of future sales, fixed and variable costs, are determined, these CFAT values are easily calculated.

CFAT=(Sales Revenue-Costs-Depreciation) (1-Tax Rate) + (Depresiation) or in an Incremental base;

DCFAT=(DS-DC+DD)(1-T)+(DD)

Where

DS=Incremental sales DC=Expenditures (costs) DD=Incremental Depreciation This equation for DCFAT is extremely convenient for calculating intermediate cash flows. It can be calculated for every month for project analysis. If incremental sales, costs and depreciation are constant for every month, the project's DCFAT will be an annuity. If not the DCFAT will have to be calculated seperately for each month which will also increase the computational complexity of the analysis.

DCFAT FORMULA IN CONTRAST

DCFAT=(DS-DC-DD)(1-T)+DD

How is this equation derived?

This equation is essentially derived from the income statement.

Operating Income After Taxes.....(S-C-D)(1-T) Operating Cash Flows.....(CFAT)(S-C-D)(1-T)+D

Recognizing incremental items only yields

DCFAT=(DS-DC-DD)(1-T)+DD

Interest on debt ignored in determining DCFAT, because our capital budgeting analysis here is concerned only with the incremental operating cash flows. It is also have to be noted that the DCFAT formula implicitly assumes the sales (S) and the costs (C) as cash items.

3 TERMINAL CASH FLOWS:

Terminal cash flows are the cash flows that are expected to occur at the point when a project's useful life ends.The Cash Flows influencing the capital budgeting decision can be decomposed into two;

a)Salvage Value of the asset(S)

b)Recovery of net working capital

a) SALVAGE VALUE: Even though a project's fixed assets usefulness has ended, they often will have some resale value.(i.e. someone else may be able to use them). In practice, the depreciated or book value of an asset is normally assumed to be the best estimate of its salvage value. Consider an asset purchased for \$50,000 which is expected to have a soluage value of \$10,000 at the end of five years, the straight-line depreciation per year is (\$50,000-\$10,000)/5=\$8,000 per year. In five years, the book value of the asset will be \$10,000 , which is equal to the purchase price \$50,000 less the accumulated depreciation \$40,000. outlays need for an initial increase in net working capital, this investment in net working capital is converted back into cash volen the project terminates. Acceptance of a project may cause a net increase in inventories and accounts payable in order to support new sales. Once the product line is dropped, the finds tied up in these noncash current items are no longer needed. The inventories can be sord and the accounts payable reduced. This can result in a net cash inflow to the firm, which must be captured in the analysis.

However in reality, working capital cannot be treated as an investment made volen the project is adopted and when the project ceases to exist, like it is treated here as simplified. Working capital can change from period to period, and additional inflows/outflows may be necessary during the life of the investment.

3.2 APPLICATION OF CFAT ANALYSES

Capital budgeting proposals are normally grouped into one of two categories during the screening phase; cost-reduction (savings) proposals or revenue expansion proposals.

- COST-REDUCTION PROPOSALS: A replacement proposal is often a cost-savings proposal.A pure cost-savings proposal provides no direct benefit in the form of increased sales, instead, the benefits core through higher future income because of cost reductions.Replacement of existing equipment or facilities with more efficient ones is the most common example of this type of investment.Plant, equipment and production facilities wear out or become obsolete over time.Because of increased maintenance and repair costs, older equipment eventually becomes too expensive to operate.More-over, even well-functioning equipment may become obsolete due to technological advances.Decisions to increase automation to reduce labor costs, also fall linto this category. These potential cost-reduction situations may offer the company opportunities to reduce variable operating costs by replacing employees or old, obsolete plant and equipment.

- REVENUE EXPANSION PROPOSALS: The second type of capital budgeting investment, the revenue expansion proposal, is the result of expanding current operations or introducing a new product line. The primary purpose of this type of investment is to increase revenues rather than to decrease costs.Proposals designed to expand operations should be considered if a firm expects future demand for its products to push the plant capacity beyond its limits. On the other hand, competition and changing consumer tastes require a constant reassesment of existing product's market appeal.Decisions must be made about the introduction of new products eliminating the obsolete and popular ones.

When a proposal expands revenue through the sale of additional goods or services, it may also reduce some costs.A project that only increases revenues and has no effect on costs is a pure revenue expansion project. NOTE: As mentioned in the beginning, investments are also made to satisfy social, legal, or environmental requirements. investments in new athletic facilities for employees or safety and pollution control devices are difficult to evaluate in this framework, because they usually involve only cash outflows.So, no (dollar) benefits can be directly measured.Such decisions are largely discretionary.A decision to install scrubber in a smelting plant maybe made to forestall an even bigger cash outflow that might result from certain lawsuits.

Such projects however fall outside our scope.

4. EVALUATION CASH FLOWS

4.1 CRITERIA FOR CAPITAL BUDGETING

A criterion or rule is needed to form the basis for decision making in deciding whether a particular project should be adopted. The one that is consistent with the goal of financial management is the best criterion. A preferred investment will adequately compensate its owner for the time value of money and for risk.

Practitioners, historically have relied on two criteria for investment decision; the payback period and accounting rate-ofreturn methods.We will review them because of their widespread popularity rather than their compatibility with the financial manager's objective.

We will then reexamine; -the net present value (NPV) and -internal rate of return (IRR)

two conceptually sound criteria, in the context of capital budgeting.

4.2 THE PAYBACK PERIOD CRITERION

The Payback Period for a project measures the number of years required to recover the initial investment.

Initial Investment Outlay

Payback Period= ------Annual Cash Inflows

Considering a project with an initial investment of \$500,000 and an expected cash inflow of \$100,000 per year for 10 years, the payback period for this project can be calculated by;

\$500,000

Payback Period=----- = 5 years. \$100,000

Even if cash flows are not same, the payback period can be calculated easily by summing the cash flows until the initial outlay is recovered.

TABLE 4.1 INITIAL OUTLAYS AND CASH INFLOWS FOR PROJECTS A AND B

	YEAR	PROJECT A	PROJECT B
Initial Outlay Net Cash Inflow	Ø	\$500,000	\$500,000
	1	\$100,000	\$200,000
	2	100,000	200,000
	3	100,000	100,000
	4	100,000	5,000
	5	100,000	2,000
	6	100,000	-0
	7	100,000	-Ø

Table 4.1 summarizes the cash flows from two projects, A and B.Both require a \$500000 outlay, their respective cash inflow patterns, however, are different.As it can easily be seen payback period for project A is five years, while that of project B is only three years. Since decision involving the payback period require choosing the project with the shorter payback period, project B will be chosen over project A.It is useful to note that firms that use the payback period to make accept/reject decisions.In such cases, projects having expected payback periods greater than this standard are rejected, and those with payback periods less than this standard are accepted.

Although the payback criterion is quite simple, there are several problems in using it for capital budgeting.

CASH FLOWS BEYOND THE PAYBACK PERIOD IGNORED

It would not make any difference even if the cash flows of project A were \$1000000 each in years 6 and 7. Project B will still be preferred to project A simply because of its shorter payback period. This aspect of the payback criterion is clearly disturbing.

-OPPOTUNITY COST CONSIDERATIONS IGNORED

It would not change the decision to choose B even if cash flows for project B were zero for the first two years and \$500000 for the third year. The pattern of cash flows within the payback period is treated as totally irrelevent. In addition factors affecting the opportunity costs of investing in the two projects -their risks-are completely ignored.

DISCOUNTED PAYBACK RULE: The discounted payback period is the number of years it takes for the discounted cash flows to yield the initial investment. Although this rule is somewhat better than the standard payback rule, which completely ignores the time value of money, it still suffers from a serious weakness.i.e. it also ignores all cash flows beyond the discounted payback period.

The Payback Period, despite the weaknesses, is popular, perhaps because it is easy to use. One other use for its use is said to be that it emphasizes the liquidity objective of managers. That is, the shorter the payback period, the quicker the project generates cash inflows. Though, it completely ignores the fact that stockholders want companies to take on projects with the highest market values.

4.3 THE ACCOUNTING RATE-OF-RETURN CRITERION

The accounting rate-of-return (AROR) criterion relates the after-tax profits

Average investment can be calculated in a variety of ways; however, we will approximate it by adding the beginning and ending values of the investment and dividing this result by 2.If two projects, X and Y, have AROR's of 15% and 20%, respectively, it is concluded that Y is better than X.

The weakness of AROR is obvious.By using profits rather than cash flows and by ignoring the time value of money, AROR has no relationship to market-determined return measures.Therefore, choosing the project with the highest AROR does not mean that the firm is choosing the project with the highest market value.

One related rate-of-return criterion is Average Return On Investment (AROI).This measure uses the average annual profit. Although the AROI corrects one of the weaknesses of AROR, it still ignores the time value of money.

4.4 NET PRESENT VALUE (NPV) CRITERION

As the flows in the payback and the ARR were recognized, people began to search for ways to improve the effectiveness of project evaluations. One such method is the Net Present Value (NPV) method, which relies on discounted cash flow methodology.

To implement this approach, we proceed as follows;

- a) Find the present value of each period's net cash flow, including both inflows and outflows, discounted at the project's cost of capital.
- b) Sum these discounted net cash flows; this sum is defined as the project's NPV.
- c) If the NPV is positive, the project should be accepted; if the NPV is negative, it should be rejected; and if two projects are mutually exclusive, the one with the higher positive NPV should be chosen.

The Net Present Value (NPV) of a project is equal to the present value of the expected stream of net cash flows from the project, discounted at the firm's cost of capital, minus the initial cost of the project.

The net present value (NPV) of a project is given by

NPV = Present Value Of Inflows - Present Value Of Outflows

$$NPV = \sum_{t=1}^{n} \frac{Rt}{(1+k)t} - CO$$

where the present values are after-tax cash inflows and outflows, respectively, which are determined opportunity cost of capital. In calculating NPV's as in equation given above, it is implicitly assumed that the intermediate cash flows from a project are reinvested at the opportunity cost of capital.

TABLE	4.2 Estimated	Cash	Flow From	Project			
	0		1	2	3	4	5
cash flows	5 (\$1,000,	000)	\$290,000	\$320,000	\$353,000	\$389,300	\$429
	\$290,000 =						
	(1+0.12)^1						
	\$320,000						
	(1+0.12)^2						
	\$353,000 =						
	(1+0.12)^3						
	\$389,300						
	(1+0.12)^4		e				
	\$429,230						
	$(1+(3) 17)^{5}$						

\$1,454,852

\$1,000,000 Less : Initial Investment

\$ 454,852

\$ 250,000 Plus Salvage value of equipment \$ 100,000 Recovery of working capital

\$ 779,230

This project would thus add \$454,852 to the value of the firm, and the firm should undertake it.

The opportunity cost of capital, especially in the context of capital budgeting, is often referred to as the required rate of return (RRR).

The required rate of return (RRR) for a project is the minimum rate of return that the project must yield to justify its acceptance.

If the NPV is positive, the project produces excess market value, if NPV is negative, the project produces negative excess market value, or economic losses. Therefore, Npv is the net or excess market value accruing to the firm on acceptance of the project.

This the <u>NPV rule</u> accepts projects with positive NPV's and nejects projects with negative NPV.

4.5 THE INTERNAL RATE OF RETURN (IRR) CRITERION

Another method of determining whether a firm should or should not accept an investment project is to calculate the internal rate of return on the project.

The Internal Rate of Return (IRR) is a discounted rate-ofreturn measure derived directly from knowledge of a project's cash flow pattern. In other words, the Internal Rate of Return (IRR) is that discount rate that makes the present value of the cash inflows equal to the present value of the cash outflows.

Alternatively, the IRR is that discount rate which makes the present value of an investment's cash inflows (PV inflows) equal to the present value of its cash outflows (PV outflows);

PV(Inflows) = PV (investment costs)

or/ $\sum_{t=15}^{n} \frac{CFt}{(1+IRR)^{t}} = 0$

for the project;

IRR = 14.5% = discount rate which forces the sum of the PV's of CF(1-4) to equal the project's cost, \$1000

One assumption in all IRR calculations is that the intermediate cash flows from the project are also reinvested at the IRR. A project is accepted or rejected by comparing its IRR to its RRR, which is the opportunity cost of capital.

So, the IRR rule accepts a project if its IRR>RRR and reject a project if its IRR<RRR.

Although, if IRR=RRR, the project is marginally acceptable; it may not make much economic sense to accept a project when the firm simply expects to recover its opportunity cost.

As IRR criterion explicitly considers the timing of the CFAT's, it satisfies the requirement that capital budgeting decisions criteria must account for the time value of money.

In effect, the IRR on a project is its expected rate of return. If the internal rate of return exceeds the cost of the funds used to finance the project, a surplus remains after paying for the capital, and this surplus accrues to the firm's stockhorders. Therefore taking on a project whose IRR exceeds its cost of capital increases shareholders wealth. On the other hand, if the internal rate of return is less than the cost of capital, then taking on the project imposes a cost on current stockholders. It is this "breakeven" characteristic that makes the IRR useful in evaluating Capital projects.

4.6 PROFITABILTY INDEX

Another method used to evaluate projects is the profitability index (PI), or the benefit/cost ratio, as it is sometimes called.

The Profitability Index (PI) is the present value of the cash inflows divided by the present value of the cash outflows.

The PI is simply a different way of presenting the same information that NPV provides.NPV is the difference between the PV of the cash inflows and cash outflows, while PI is the ratio of these two values.

The PI rule accepts if PI>1 and rejects projects if PI<1.

The PI is a relative measure in that it measures the benefits per dollar of investment adjusted for time value, as the present value of the cash outflows represents the true, timeadjusted investment in the project.

NPV critorion on the otherhand, is an absolute measure.

When should the PI criterion be used to select capital budgeting projects?

Since both the NPV and the PI criterion are essentially the same, they yield identical accept/reject decisions.That is, a project that is acceptable with the PI rule.However, the PI and the NPV can lead to conflicting decisions when one of two projects has to be chosen.

CONFLICTS IN USING THE IRR AND NPV CRITERIA:

One would not normally encounter a problem with using either the NPV or the IRR if capital budgeting projects were evaluated

one at a time. The accept/reject decision would be identical by both criteria. (This observation, does not, however apply to cases where multiple IRR's exist or where an IRR cannot be determined.) For they are mutually exclusive, when two or more projects are to be ranked, the ranking based on their IRR's may differ from the ranking based on their NPV's.

That is, the most attractive investment as measured with one the two methods is not the same as the best investment of according to the other method. The reason for this difference is the second assumption underlying the use of the discounted cash flow tachniques discussed. The reinvestment rate for the net cash flows generated from an investment is different for the two methods, NPV and IRR. The NPV method assumes that the reinvestment takes place at the firm's cost of capital, which is lower than the IRR for all acceptable investments. In contrast, the IRR method assumes that the net cash flows are reinvestment at the IRR throughout the life of the investment. Thus, the two reinvestment rates are different, which in turn can cause a ranking difference between the NPV method and IRR method. The choice in between the NPV method and the IRR method is often made on the basis of the reinvestment rate that is most realistic. The NPV method usually is preferred over the IRR method, since the cost of capital stays the same from investment to investment while the internal rate of return can change with each investment.

ILLUSTRATION OF THE DIFFERENCE IN RANKING

We will try to illustrate how a ranking difference can occur between the NPV method.

Consider two alternative investments, Project A and Project B with different patterns of annual net cash flows, in the case of S-company which has a cost of capital of 10%

The two projects are alternatives because only one of them will be chosen. The data prepared is as follows;

F	Project A	Project B
Initial Cost	\$(10000)	\$(10000)
Expected Life	3 years	3 years
Net Cash Flows;		
Year 1	\$4,747.21	-Ø-
Year 2	4,747.21	-Ø-
Year 3	4,747.21	\$16,430.00
Net Present Value	1,805.84 (a)	2,343.86 (b)
Internal Rate Of Return	20% (c)	18% (d)

(a) \$4,747.21 discounted at 10% for 3 years using factor from table A-4;

 $2.4869 \times $4,747.21 = $11,805.84 - $10,000.00 = $1,805.84$

(b) \$16,430.00 discounted at 10% for 3 years using factor from Table A-3;

0.7513 × \$16,430 = \$12,343.86 - \$10,000.00 = \$2,343.86

(c) \$10,000

---- = 2.1065 or 20% from 3 year row of Table A-4
\$4,747.21

(d) \$10,000----- = 0.6086 or 18% from 3 year row of Table A-3 \$16,430

The pattern of the annual net cash flows is significantly different for the two projects. Project A will generate annual net cash flows of \$4,747.21 for 3 years, or a total of \$14,241.63. Project B will produce zero net cash flows for the first 2 years of its life and \$16,430 during the third and final year. In this case, the differences in the annual cash flows cause conflict rankings of the two investments with the NPV method and the IRR of 20% (Compared with 18% for project B), whereas Project B has the largest NPV of \$2,343.86 (Compared with \$1,805.84 for project A). Even though Project A produces less total net cash flows, it returns the net cash flows, faster and the assumption with the IRR method is that these funds are available for reinvestment at the 20% rate (when the time value of money is relatively high). The choice between the two methods with these conflicting results depends on the rate at which the firm can reinvest the net cash flows. If Project A's IRR of 20% or better is not realistic for all reinvestment, Project B should be selected because of its higher NPV.

CONFLICTS BETWEEN NPV AND PI IN PROJECT RANKING

NPV and PI can lead to different Project selection, just as IRR and NPV can lead to conficts in ranking. PI, as it is a relative measure of profitability, it ignores the size of the initial investment. Which one of the following projects should be selected if only one can be accepted?

I

		Initial	gar anna anna aine aine dhur dhin aine aine anna anna anna
Project	NPV	Investment	ΡI
A	\$400	\$ 800	1.50
В	800	1,400	1.44

It should be recognized that both projects A and B are acceptable by both NPV and PI methods. But since, only one project can be chosen, they must be ranked. The NPV criterion will choose project B over project A, while the PI criterion will prefer project A over project B. However, project B will lead to the greater increase in firm value, since it has the higher NPV, and should be the one selected.

5.CAPITAL RATIONING:

By applying the RRR to each projects expected cash flows and then accepting every project that has a positive NPV, the firm ultimately determines the amount of funds needed for investments.(i.e. the amount of the capital budget)

However this process is often reversed by firms, in effect, deciding which project to accept after imposing a limitation by on capital expenditures, during a particular year. It is important to note that this approach is incostistent with the goal of value maximization. Instead of accepting all attractive investment opportunities, the firm attempts to select that combination of projects that will provide the greatest increment the firms value, subject to the budget size constraint. This in behavior may involve, for example, accepting smaller, less profitable projects that complete use up the constrained budget rather than accepting a few larger projects that result in less than a 100% commitment of the funds available.

In these situations, where capital expenditures are subject to a constraint, the firm is described as facing <u>CAPITAL</u> RATIONING.

Capital rationing is the process whereby a firm allocates a limited amount of capital to wealth maximizing projects.

REASONS FOR SEEMINGLY IRRATIONAL FUNDING.

TO CONSTRAIN ORGANIZATION UNITS GROWTH.

A company that feels that its divisional managers are over enthusiastic in their capital budget requests might choose to impose a capital expenditure limit for a particular division , moreover , divisions may have few acceptable projects but will undertake undesirable projects simply to allocate all their funds.

TO CONSTRAIN FINANCING TO INTERNALLY GENERATED FUNDS:

Management, may sometimes prefer to avoid the use of long term debt or new equity issues to fund projects. This attitude usually generates from on aversion to the risk of debt or the fear of losing ownership control if new shares of common stock are sold to outsiders. In such cases, the size of the capital budget becomes restricted to the availability of "excess" cash inflows from operations. Management must weigh the loss of incremental wealth from rejecting acceptable projects due to any capital constraint against the "benefits" gained by being debt free or retaining control.

5.1 PROJECT SELECTION UNDER CAPITAL RATIONING

Before commencing to project selection under rationing it is necessary to understand that some projects are indivisible, whereas others are divisible. <u>Indivisible</u> projects must be accepted or rejected in their entirety. For example a jet plane purchase decision can either be accept or reject. It makes no sense to think about accepting half of the project. Projects may also be <u>divisible</u>. The tyre changing of the car fleet of a rental company for example, we can think of one half or one-third of the project. That is the company can replace the tires on just part of its fleet.

INDIVISIBLE PROJECTS:

Consider the T-Company, which has decided to reinvest Maximum of \$30,000.-in new projects this year. T-Company's RRR is 15% and it has identified four potential(Independent) investments with the following information.

CAPITAL	BUDGET = \$30,000.	
Project	Initial Investment	NPV
A B C D	\$15,000 \$8,000 \$12,000 \$30,000	\$1,970 \$1,130 \$6,840 \$6,900

Which projects schould be accepted, if all project are indivisible.

RULE:With capital rationing, maximizing value requires that managers choose that combination of projects that maximizes the sum of their NPV's without exceeding the capital constraint. First identify all feasible projects combinations and the associated NPV for each combination. By feasible we mean that the combination does not exceed the capital constraint.

CAPITAL BUDGET : \$30,000

Feasible projects combinations*	Size of capital budget	NPV (RRR=15%)
	\$13.000	\$1,970
B	\$ 8,000	\$1,130
C	\$12,000	\$6,840
D	\$30,000	\$6,900
A+B	\$23,000	\$3,100
A+C	\$27,000	\$8,810
B+C	\$20,000	\$7,970

*All other combinations exceed the \$30,000.- capital budget constraint.

From the above table, the combination of A+C is the best beacuse T-Company will recive an NPV of \$8,810 with \$27,000 investment. All other projects must be rejected including D which appeares to be the best at first glance.

DIVISIBLE PROJECTS:

What if T-Companies four projects were divisible? When projects are divisible, the PI can be used to make rights decision.

<u>RULE:</u>If projects are divisible and capital constraint exists, rank projects by their PI value from highest to lowest, and then select all the highest-ranked projects that do not exceed the imposed capital budget.

The below table summarizes the relevant information for this analysis.

CAPITAL BUDGET =\$30,000

Project	Initial Investment	NPV (RRR=15%)	Profitability Index(PI)	Rank
A	\$15,000	\$1,970	1.13	4
В	\$ 8,000	\$1,130	1.14	3
C	\$12,000	\$6,840	1.57	1
D	\$30,000	\$6,900	1.23	2

Based on the PI's , the projects are ranked in descending order as C,D,B and A. As, table indicates, C, requiring a \$12,000 investment, should be accepted first. That leaves \$18,000 for further investing.Project D should be picked next; however this requires \$30,000 and only \$18,000 remains.Therefore only 60% of project D can be undertaken.

Steps In deciding

STEP 1: Accept project C first, with PI=1.57. Since C=\$12000 < \$30000, all funds have not been allocated, so proceed to Step 2.

<u>STEP 2:</u> Accept project D next, with PI=1.23. However C+0=\$12000 + \$30000 > \$30000; therefore solve the following equation to determine what portion of D(Xc) to Accept.

> \$30000 - \$12000Xd = ----- = 0.6 30000

Because fractional projects are allowed, T-company's capital budget would be composed of project C and 60% of project D.

Why The PI Criterion Applies When Capital Is Rationed

When the PI Criterion was examined, it was said that ranking projects by their PI's could be misleading because the PI ignores the scale of investment.Yet, as has just been shown, PI can be useful in capital rationing situations when projects are divisible. Why does the PI apply in this case? Without Capital rationing, decisins are based on NPV because the ultimate objective is to pick all projects that increase wealth (NPV>0). However, with Capital rationing, funds are not available to finance all projects that increase wealth. Our objective now becomes the maximization of the increment in wealth per dollar invested. That is, a financial manager faced with capital rationing must pick projects such that the present value of benefits for every dollar invested is as wish as possible. This is exactly what the PI will do. An essential part of capital budgeting is the estimation of the cost of raising the capital to invest.

The firm can raise investment funds internally(i.e.from undistributed profits) or externally(i.e.by borrowing and from selling stocks) The cost of using internal funds is the opportunity cost or foregone return on these funds outside the firm. The cost of external funds is the lowest rate of return that lenders and stock holders require to lend to or invest their funds in the firm.We will now, examine how the cost of debt(i.e.the cost of raising capital by borrowing) and the cost of equity capital(i.e.the cost of capital by selling stocks) are determined. The estimation of the cost of debt is fairly straight forward. On the other hand, there are several methods of estimating the cost of equity capital.

A firms cost of capital is critically important for three reasons;

- 1)Maximizing the value of a firm requires that the costs of all inputs, including capital, be minimized, and to minimize the cost of capital we must be able to estimate it.
- 2)Capital budgeting decisions require an estimate of the cost of capital.
- 3)Many other types of decisions, including those related to public utility regulation, leasing, bond refunding, and short-term asset management, require estimates of the cost of capital.

CAPITAL COMPONENTS AND COSTS:

We first identify and then determine the cost of each component, and we then combine the component costs to form the weighted average cost of capital (WACC) in developing the firms overall cost of capital. Capital, represents the fund used to finance the firms assets and operations. Capital constitutes the entire right-hand side of the balance sheet, including both, short term and long-term debt, preferred stock, and common equity.

CAPITAL COMPONENTS:

We should first decide which capital sources should be included in estimating the WACC. We will focus on the development of the cost of capital for capital budgeting purposes, since the cost of capital is used primarily in the process of making longterm investment decision.

First, consider the firms short-term , non-interest bearing liabilities: accounts payable, accrued wages and accrued taxes. All these items arise from normal operations. In capital budgeting analysis, the dollar amount of the spontoneously generated liabilities associate with a given project is subtracted from the amount that otherwise would be required to finance the project.

Since we are concerned only with the cost of the non-

spontaneous capital, sportaneously generated current liabilities are not included when the WACC is estimated.

Consideration should also be given to short term loans. If short-term debt is only used as temporary financing to support cyclical or seasonal fluctuations in current assets, it should not be included in the firm's WACC. However, if the firm does use short-term debt as part of its permanent financing, then such debt should be included when the cost of capital is estimated.We assume at this point that interest-bearing short term debt will is used to support cyclical or seasonal working capital, and since our primary focus is on developing a cost of capital for use in capital budgeting, we estimate the WACC. Long term debt, preferned stock, and common equity(common stock plus retaired earnings)are the primary sources of capital, for capital expansion, so they are the components included in the WACC estimate.

From this, the relevant capital components for cost of capital purposes include.

1) The portion of short term interest bearing debt that is considered to be permanent financing.

- 2)All long term debt.
- 3)All preferred stock

4)All common equity.

TAXES:

In developing the costs for the different capital components, the issues at taxes arises; should we use a before or an after tax cost? Stockholders are concerned primarily with the cash flows that are available for their use; meaning, those cash flows available to common shareholders after corporate taxes have been paid. The most common approach to capital budgeting, to include the tax benefits of debt financing in the WACC rather than in the cash flows, so all component costs are costs on an after tax basis.

6.1 COST OF DEBT:

The relevant cost of debt is the after tax cost of new debt. Some problems arise in practice, although estimating this cost is conceptually straightforward, first it is necessary to decide whether or not short term debt should be included in the WACC. Second, not all long term debt has a fixed and known payment schedule; Firms use both fixed and floating rate debt, straight and convertible debt, and debt with and without sinking funds, where each form of debt generally has a somewhat different cost.

The type of the debt actually used will depend on the specific assets to be financed and on capital market conditions as they develop over time. So, it is unlikely that the financial manager will know at the start of a planning period the exact types and amounts of debt that will be used during the planning period.

Consider N-Company uses 30 year bonds to raise long term debt capital. Thus, for planning purposes, N-Company managers include only long term debt in their WACC estimate, and they assume that this debt will consist of 30 year bonds.

Assume that N-Company's bankers stated that a new 30 year, noncallable, straight bond issue would require an 11 percent coupon rate with semi-annual payments, and that would be offered to the public at a \$1,000 per value.

Flotation costs are estimated to be 1 percent of the issue, or \$10 for every \$1,000 par value bond. Thus, the net proceeds from each bond would be \$1,000 minus a \$10 flotation couts, or \$990. N-Company's marginal tax rate is 40 percent. With this informatioin, we would estimate the cost of debt in two-steps.

1)Find the before tax flotation adjusted cost to the company.

Net Proceeds 2n Semiannual Interest Payment Par Value = Σ of Bonds t=1 (1+kd/2)^t (1+kd/2)^2n

> 2n \$55 \$1,000 \$990 = 2 _ _ + _

t=1 (1+kd/2)^t (1+kd/2)^60

We find kd/2=5.56% So the flotation adjusted cost of debt is kd=11.12%

2)Adjust for taxes using this equation. After tax cost of debt= Pre-tax cost(1-T) = (Flotation-adjusted kd)(1-T) = 11.12%(0.60)=6.67%

In the example, we used a marginal tax rate of 40 percent. So, we were assuming that N-Company's marginal tax rate over the next 30 years will remain at 40 percent. However there are three potential problems with this assumption.

1) The value of the tax deduction depends on the taxable income for each year, and a change in taxable income might lead to a change in the after tax cost of debt.

2)Tax losses can only be carried back for three years, therefore, several years of consecutive losses would mean that the benefits of tax deductability could not be realized in the year the interest is paid. Instead, this benefit would be delayed until the firm becomes profitable, and this would raise the after tax cost of debt.

3) Tax rate could increase or decrease, which would also have an effect on the after tax debt.

For all these reasons it should be recognized that firms cannot be certain of the true effects of tax deductability, so the true after tax cost of debt could be higher or lower than the estimated cost.

6.2 COST OF PREFERRED STOCK:

A number of firms use preferred stocks as part of thier permanent financing mix. To determine this cost , we first underline that preferred dividends. Like common dividends are not tax deductable.Therefore, no tax adjustment is necessary while calculating the cost of preferred stocks. Second important note is that, although preferred used to be issued without a stated maturity date, almost all preferred issued recently does have a stated maturity, a sinking fund or both. Finally, although it is not mandatory to pay preferred stock dividends firms generally do have every intention of paying preferred dividends because if they fail to do so;

- 1) They cannot pay dividends on their common stock.
- 2) They will find it difficult to raise additional funds in the capital markets.
- 3) In some cases preferred stock holders have the right to assume control of the firm.

Assume that N-Company investment bankers indicated that the firm could sell perpetual preferred stock with a 10 percent yield. If the stock had a par value of \$100, then the annual dividend would be \$10. In addition to this flotation costs would amount to 2.5 percent of the par value. Thus the firm would net \$97.50 from each share sold, and it would have an obligation to pay \$10 dividends per share per year. Thus we calculate the component cost of preferred stock as follows;

Comp	ponent cost		D(p)
of	preferred	=	kd(r)=
	stock		P(n)

Here D(p) is the annual preferred dividend and P(n) is the price the firm receives net of flotation costs. So we find the N-Companys cost of preferred stock to be 10.26 percent.

 $\frac{D(p)}{K(p)=----} = \frac{\$10}{-----} = 0.1026 = 10.26\%$ $\frac{P(n)}{\$97.50}$

COST OF RETAINED EARNINGS:

A firm can raise common equity capital in two ways;

- i)By retaining earnings
- ii)By issuing new common stock.

Thus when we consider N-Company's component cost of equity, we must consider the cost of two different types of equity.

The costs of debt and preferred stock are based on the return that investors require on these securities, and the cost of equity obtained by retaining earnings can be defined similarly; It is K(S), the rate of return stock holders require on the firm's common stock. The firm's net income after taxes and after preferred dividends belongs to its common stockholders. Bond holders are compensated by interest payments;

Preferred stockholders are compensated by fixed dividend payments; and firms retaining income belongs to its common stockholders and serves to "pay the rent" on stockholders capital.

Management may either pay out earnings in the form of dividends or retain earnings for reinvestment in the business. If part of the earnings is retained, an opportunity cost is incurred; Stockholders could have received those earnings as dividends and then invested that money in stocks, bonds real estate and so on. Thus the firm should earn on its retained earnings at least as much as its stockholders themselves could earn on alternative investments of equivalent risk.

So stockholders expected to earn k(s) rate of return on their investment of buying the stock of the firm.Therefore if our firm cannot invest retained earnings and earn at least k(s) then it should pay these earnings to its stockholders so that they can invest the money themselves in assets that do provide a return of k(s).

6.3 COST OF EQUITY: DIVIDEND DISCOUNT MODEL APPROACH

The cost of equity capital is by far the most difficult cost to measure. Equity capital can be raised either internally by retaining earnings or externally by selling common stock. In theory, the cost of both may be thought of as the minimum rate of return that the company must earn on the equity-financed portion of an investment project in order to leave the market price of the firm's common stock unchanged. If the firm invests in projects having a return less than this required return, the market price of the stock will suffer over the long run.

In the context of the dividend discount valuation model the cost of equity capital, Ke, can be thought of as the discount rate that equates the present value of all expected future dividends per share, as perceived by investors at the margin, with the current market price per share.



where P0 is the market price of a share of stock at time 0, Dt is the dividend per share expected to be paid at the end of time period t, Ke is the appropriate discount rate, and \sum represents the sum of the discounted future dividends from period 1 through infinity, depicted by the symbol &.

ESTIMATING FUTURE DIVIDENS. If we successfully estimate the stream of future dividends that the market expects, it is an easy matter to solve for the discount rate that equates this cash

stream with the current market price of the stock. Because expected future dividens are not directly observable, they must be estimated. Here lies the major difficult in estimating the cost of equity capital.

If, for example, dividends are expected to grow at an 8 percent annual rate into the foreseeable future, the constant growth model might be used to determine the required rate of return. If the expected dividend in the first year were \$2 and the present market price were \$27, we would have

$$Ke = (D1/P0) + g$$

$$=$$
 ($\frac{15.4\%}{100}$) + .08 = 15.4\%

This rate would then be used as an estimate of the firm's required return on equilty capital. The key element in this equation is an accurate measurement of the growth in dividens per share, g, as perceived by investors at the margin.

GROWTH PHASES If the growth in dividens is expected to taper off in the future, the constant growth model will not do. A modification of is then made in order. Frequently, the transition in dividend growth is from an above-normal growth at a 15 percent compound rate for five years, at a 10 percent rate for the next five years, and then grow at a 5 percent rate, we would have ;

 $P=0 = \sum_{t=1}^{5} \frac{D0(1.15)^{5}}{(1+Ke)} + \sum_{t=6}^{5} \frac{D5(1.10)^{T-5}}{(1+Ke)^{t}} + \sum_{t=11}^{8} \frac{D10(1.05)^{T-10}}{(1+Ke)^{t}}$

We see that the current dividend, D0, is the base on which the expected growth in future dividends is built. By solving for Ke, we obtain the cost of equity capital. One would use the method illustrated to solve for Ke. For example, if the current dividend, D0, were \$2 a share and the market price per share, P0, were \$70, Ke in this equation would be 10.42 percent. For other patterns of expected future growth, this equation can easily be modified to deal with the particular situation.

6.4 CAPITAL ASSET PRISING MODEL

Another method commonly used to estimate the equity cost of capital is the **capital asset pricing model (CAPM)**. This takes into consideration not only the risk differential between common stocks and government securities but also the risk differential between the common stock of the firm and the average common stock of all firms or broad-based market portfolio. The CAPM implies the following required rate of return, Rj, for a share of common stock:

$$Rj = Rf + (Rm - Rf) \beta j$$

where Rf is the risk-free rate, Rm is the expected return for the

market portfolio, and Bj is the beta coefficient for stock j. The risk-return relationship is described by this equation and is known as the **security market line**. It implies that in market equilibrium, security prices will be such that there is a linear trade-off between the required rate of return and systematic risk, as measured by beta.

BETA.Beta is a measure of the responsiveness of the excess returns for a security (in excess of the risk-free rate) to those of the market, using some broad-based index such as the S&P 500 Index as a surrogate for the market portfolio. If the historical relationship between security returns and those for the market portofolio is belived to be a reasonable proxy for the future, one can use past returns to compute beta for a stock. Where a characteristic line is fitted to the relationship between returns in xcess of the risk-free rate for a stock and those for the market index. Beta is defined as the slope of this line. To free us of the need to calcualte beta information directly, several services (for example, Value Line Investment Survey and Standard & Poor's Stock Reports) provide historical beta information on a large number of publicly traded stock. These services allow us to obtain the beta for a stock easily, thereby greatly facilitating the calculation of the cost of equity capital.

If the past is thought to be a good proxy for the future, we can use above equation to compute the cost of equity capital for a company. To illustrate, suppose that the beta for P-Company was found to be 1.20, based on monthly excess return data over the last five years. This beta value tells us that the stock's excess return goes up or down by a somewhat greater percentage than does the excess return for the market. (A beta of 1.00 means that excess returns for the stock vary proportionally with excess returns for the market portfolio.) Thus, the stock of P-Company has more unavoidable, or systematic, risk than does the market as a whole. Management believes that this past relationship is likely to hold in the future. Furthermore, assume that a rate of return of about 13 percent on stocks in general is expected to prevail and that a risk-free rate of 8 percent is expected.

This is all the information that we need in order to compute the required rate of return on equity for P-Company. Using equation above, the cost of equity capital would be

 $R_j = .08 + (.13 - .08)(1.20) = 14\%$

Thus, the estimated required rate of return for P-Company is approximately 14 percent. In essence, we are saying that this is the rate of return that investors expect the company to earn on its equity.

RISK-FREE RATE AND MARKET RETURN. In addition to beta, it is important that the numbers used for the risk-free rate and the expected market return in the equation be the best possible estimates of the future. The risk-free return estimate is controversial-not as to the type of security return that should be used but as to the security's relevant maturity. Most agree that a Treasury security, which is backed by the full faith and credit of the government, is the proper instrument to use in making a "risk-free" return estimate. But the choice of a proper maturity is another matter. As the CAPM is a one-period model, some contend that a short-term rate, such as that for three-month Treasury bills, is in order. Others argue that because capital investment projects are long-lived, a long-term Treasury bond rate should be used. Still others, we will use intermediate-term rate, such as that on one - or two-year Treasury securities. This is a middle position in a rather murky area. With an upwordsloping **yield curve** (graph of the relatioship between yields and maturity), the longer the maturity, the higher the risk-free rate.

measurements were exact and the assumption of a perfect If capital market held, the cost of equity determined by this method would be the same as that provided by a dividend discount model. Note that the latter estimate is the discount rate that equates the present value of the stream of expected future dividends with the current market price of the stock. It should be clear that we can only approximate the cost of equity capital. The methods suggested enable such an approximation more or less accurately, depending on the situation. For a large company whose stock is actively traded on the Stock Exchange and whose systematic risk is close to that of the market as a whole, we can usually estimate more confidently than we can for a moderate-sized company whose stock is inactively traded in the over-the-counter market and whose systematic risk is very large. We must live with the inexactness involved in the measurement process and try to do as good a job as possible.

COST OF EQUITY:BEFORE-TAX COST OF DEBT PLUS RISK PREMIUM APPROACH Rather than estimate the required return on equity capital using the sophisticated methods previously described, some use a relatively simple approach. Here the company's before-tax cost of debt will exceed the risk-free rate by a risk premium. The greater the risk of the firm, the greater this premium, and the more interest the firm must pay in order to borrow. The relationship can be illustrated as ;



Systematic Risk (beta)

On the horizontal axis, the firm's debt is shown to have systematic risk equal to Bd. As a result, its required return is Kd, which exceeds the risk-free rate of Rf.

In addition to this risk premium, the common stock of a company must provide a higher expected return than the debt of the same company. The reason is that there is more systematic risk involved. This phenomenon is also illustrated in the figure. We see that for an equity beta of Be, an expected return of Ke is required and that this percentage exceeds the company's beforetax cost of debt, Kd. The historical risk premium in expected return for stocks over corporate bonds has been around 3 percent. If this seemed reasonable for a particular company, one could use the firm's before-tax cost of debt as a base and add to it a premium of around 3 percent in order to estimate its cost of equity capital.

Suppose that P-Company's bonds sell in the market to yield 11 percent. Using the mentioned approach, we find the company's approximate cost of equity as ;

	Before-tax		Risk premium in
Ke =	Cost of	+	Expected return fo
	Debt(Kd)		Stock over debt
=	11%	+	3% = 14%

This percentage would then be used as an estimate of the cost of equity capital. The advantage of this approach is that one does not have to use beta information and make the calculation involved in the previous equation. One disadvantage is that it does not allow for changing risk premiums over time. Also, because the 3 percent risk premium is based on an average for companies overall, the approach is not as accurate as either of the other methods discussed for estimating the required return on equity capital for a specific company. It does, however, offer an alternative method of estimating the cost of equity capital that falls within the overall framework of the capitalasset pricing model. It also provides a check on the reasonableness of the answers we get from applying the more complicated estimation techniques.

6.5 WEIGHTED AVERAGE COST OF CAPITAL

Once we have computed the costs of the individual components of the firm's financing, we would assign weights to each financing source according to some standard and then calculate a weighted average cost of capital (WACC). Thus, the firm's

Cost of Capital = $\sum_{x=1}^{n} K_{x}(W_{x})$

where Kx is the after-tax cost of the xth method of financing, Wx is the weight given to that method of financing as a percentage of the firm's total financing, and \geq denotes the summation for financing methods 1 through **n**. To illustrate the calculations involved, suppose that a firm had the following financing at the latest balance sheet statement date, where the amounts shown in the next table represent market values.

	AMOUNT OF FINANCING	PROPORTION OF TOTAL FINANCING
DEBT PREFERRED STOCK COMMON STOCK EQUITY	\$ 30 million 10 million 60 million	30% 10 40
	\$ 100 million	100%

Remember, common stock equity is the sum total of common stock at par, additional paid-in capital, and retained earnings. For market value purposes, however, it is represented by the current market price per share of common stock times the number of shares outstanding. In calculating proportions, it is important that we use **market value** as opposed to **book value** weights. Because we are trying to maximize the value of the firm to its shareholders, only market value weights are consistent with our objective. Market values are used in the calculation of costs of the various components of financing, so market value weights should be used in determining the weighted average cost of capital. (Also, we are implicitly assuming that the current financing proportions will be maintained into the future.

To continue with our illustration, suppose that the firm computed the following after-tax costs for the component sources

	COST
1/ 1/m	
DEE!	6.6%
PREFERRED STOCK	10.2
CUMMON STOCK EQUITY	14.0

Again we emphasize that these costs must be present-day costs based on current financial market conditions. Past costs of financing have no bearing on the required rate of return to be applied to new projects. Given the costs shown, the wighted average cost of capital for this example problem is determined as follows:

	the second	
(1)	(2)	$(1) \times (2)$
COST	PROPORTION OF TOTAL FINANCING	WEIGHTED COST
6.6% 10.2 14.0	30% 10 60	1.98% 1.02 8.40
	100%	11.40%
	(1) COST 6.6% 10.2 14.0	(1) (2) COST PROPORTION OF TOTAL FINANCING 6.6% 30% 10.2 10 14.0 60

Thus, given the assumptions of this example, 11.4 percent represents the weighted average cost of the component sources of financing, where each component is weighted according to market value proportions.

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