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# MEASURING RETURN ON INVESTMENTS

In chapter 4, we developed a process for estimating costs of equity, debt and capital and presented an argument that the cost of capital is the minimum acceptable hurdle rate. We also argued that a project has to earn a return greater than this hurdle rate to create value to the owners of a business. In this chapter, we turn to the question of how best to measure the return on a project. In doing so, we will attempt to answer the following questions:

- What is a project? In particular, how general is the definition of an investment and what are the different types of investment decisions that firms have to make?
- In measuring the return on a project, should we look at the cash flows generated by the project or at the accounting earnings?
- If the returns on a project are unevenly spread over time, how do we consider (or should we not consider) differences in returns across time?

We will illustrate the basics of investment analysis using three hypothetical projects – an online book ordering service for Bookscape, a new theme park in Thailand for Disney and a plant to manufacture linerboard for Aracruz Cellulose.

# What is a project?

Investment analysis concerns which projects to accept and which to reject; accordingly, the question of what comprises a "project" is central to this and the

following chapters. The conventional project analyzed in capital budgeting has three criteria: (1) a large up-front cost, (2) cash flows for a specific time period, and (3) a salvage value at the end,

*Salvage Value*: This is the estimated liquidation value of the assets invested in the projects at the end of the project life.

which captures the value of the assets of the project when the project ends. While such projects undoubtedly form a significant proportion of investment decisions, especially for manufacturing firms, it would be a mistake to assume that investment decision analysis stops there. If a project is defined more broadly to include any decision that results in using the scarce resources of a business, then everything from strategic decisions and acquisitions to decisions about which air conditioning system to use in a building would fall within its reach.

Defined broadly then, any of the following decisions would qualify as projects:

- Major strategic decisions to enter new areas of business (such as Disney's foray into real estate or Deutsche Bank's into investment banking) or new markets (such as Disney television's expansion into Latin America)
- Acquisitions of other firms (such as Disney's acquisition of Capital Cities or Deutsche Bank's acquisition of Morgan Grenfell)
- Decisions on new ventures within existing businesses or markets, such as the one made by Disney to expand its Orlando theme park to include an Animal Kingdom or the decision to produce a new animated children's movie.
- Decisions that may change the way existing ventures and projects are run, such as decisions on deciding programming schedules on the Disney channel or changing inventory policy at Bookscape.
- 5. Decisions on how best to deliver a service that is necessary for the business to run smoothly. A good example would be Deutsche Bank's decision on what type of financial information system to acquire to allow traders and investment bankers to do their jobs. While the information system itself might not deliver revenues and profits,

it is an indispensable component for other revenue *Mutually Excl* group of projects.

Investment decisions can be categorized on a number of different dimensions. The first relates to how the project affects other projects the firm is *Mutually Exclusive Projects:* A group of projects is said to be mutually exclusive, when acceptance of one of the projects implies that the rest have to be rejected.

considering and analyzing. While some projects are independent of the analysis of any other projects, and thus can be analyzed separately, other projects are mutually exclusive — i.e., taking one project will mean rejecting other projects; in this case, all of the projects will have to be considered together. At the other extreme, some projects are pre-requisites for other projects down the road. In general, projects can be categorized as falling somewhere on the continuum between pre-requisites and mutually exclusive, as depicted in Figure 5.1.

	Figure 5.1: The P	roject Continuum	
Pre-requisit	Complementary	Independent	Mutually Exclusive
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		L,	

The second dimension that can be used to classify is the ability of the project to generate revenues or reduce costs. The decision rules that analyze revenue generating projects attempt to evaluate whether the earnings or cash flows from the projects justify the investment needed to implement them. When it comes to cost-reduction projects, the decision rules examine whether the reduction in costs justifies the up-front investment needed for the projects.

## Illustration 5.1: Project Descriptions – Disney, Aracruz and Bookscape

In this chapter and parts of the next, we will use three hypothetical projects to illustrate the basics of investment analysis.

- The first project we will look at is a proposal by Bookscape to add an *on-line book ordering and information service*. While the impetus for this proposal comes from the success of on-line book stores like Amazon, this on-line service will be more focused on helping customers research books and find the ones they need rather than on price. Thus, if Bookscape decides to add this service, it will have to hire and train two well qualified individuals to answer customer queries, in addition to investing in the computer equipment and phone lines that the service will require. This project analysis will help illustrate some of the issues that come up when private businesses look at investments and also when businesses take on projects that have a different risk profile.
- The second project we will analyze is a *proposed theme park for Disney in Bangkok*, Thailand. Bangkok Disneyworld, which will be patterned on Euro Disney in Paris and Disney World in Florida, will require a huge investment in infrastructure and take several years to complete. This project analysis will bring several issues to the forefront, including questions of how to deal with projects when the cash flows are in a foreign currency and what to do when projects have very long lives.

• The third project we will consider is a *plant in Brazil to manufacture linerboard* for Aracruz Cellulose. Linerboard is a stiffened paper product that can be transformed into cardboard boxes. This investment is a more conventional one, with an initial investment, a fixed lifetime and a salvage value at the end. We will, however, do the analysis for this project from an equity standpoint to illustrate the generality of investment analysis. In addition, in light of concerns about inflation, we will do the analysis entirely in real terms.

# Hurdle rates for firms versus Hurdle rates for projects

In the last chapter, we developed a process for estimating the costs of equity and capital for firms. In this chapter, we will extend the discussion to hurdle rates in the context of new or individual investments.

## Using the firm's hurdle rate for individual projects

Can we use the costs of equity and capital that we have estimated for the firms for these projects? In some cases we can, but only if all investments made by a firm are similar in terms of their risk exposure. As a firm's investments become more diverse, in terms of their risk exposure, the firm is less able to use its cost of equity and capital to evaluate these projects. Projects that are riskier have to be assessed using a higher cost of equity and capital than projects that are safer. In this chapter, we consider how to estimate project costs of equity and capital.

What would happen if a firm chose to use its cost of equity and capital to evaluate all projects? This firm would find itself over investing in risky projects and under investing in safe projects. Over time, the firm will become riskier, as its safer businesses find themselves unable to compete with riskier businesses.

### **Cost of Equity for Projects**

In assessing the beta for a project, we will consider three possible scenarios. The first scenario is the one where all the projects considered by a firm are similar in their exposure to risk; this homogeneity makes risk assessment simple. The second scenario is one where a firm is in multiple businesses with different exposures to risk, but projects

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within each business have the same risk exposure. The third scenario is the most complicated one, where each project considered by a firm has a different exposure to risk.

## 1. Single Business; Project Risk similar within business

When a firm operates in only one business and all projects within that business share the same risk profile, the firm can use its overall cost of equity as the cost of equity for the project. Since we estimated the cost of equity using a beta for the firm in the last chapter, this would mean that we would use the same beta to estimate the cost of equity for each project that the firm analyzes. The advantage of this approach is that it does not require risk estimation prior to every project, providing managers with a fixed benchmark for their project investments. The approach is restricting, though, since it can be usefully applied only to companies that are in one line of business and take on homogeneous projects.

# 2. Multiple Businesses with Different Risk Profiles: Project Risk similar within each Business

When firms operate in more than one line of business, the risk profiles are likely to be different across different businesses. If we make the assumption that projects taken within each business have the same risk profile, we can estimate the cost of equity for each business separately and use that cost of equity for all projects within that business. Riskier businesses will have higher costs of equity than safer businesses, and projects taken by riskier businesses will have to cover these higher costs. Imposing the firm's cost of equity on all projects in all businesses will lead to over investing in risky businesses (since the cost of equity will be set too low) and under investing in safe businesses (since the cost of equity will be set too high).

How do we estimate the cost of equity for individual businesses? When the approach requires equity betas, we cannot fall back on the conventional regression approach (in the CAPM) or factor analysis (in the APM), since these approaches require past prices. Instead, we have to use one of the two approaches that we described in the last section as alternatives to regression betas – bottom-up betas based upon other publicly traded firms in the same business or accounting betas, estimated based upon the accounting earnings for the division.

### 3. Projects with Different Risk Profiles

As a purist, you could argue that each project's risk profile is, in fact, unique, and that it is inappropriate to use either the firm's cost of equity or divisional costs of equity to assess projects. While this may be true, we have to consider the trade off. Given that small differences in the cost of equity should not make a significant difference in our investment decisions, we have to consider whether the added benefits of analyzing each project individually exceed the costs of doing so.

When would it make sense to assess a project's risk individually? If a project is large in terms of investment needs, relative to the firm assessing it, and has a very different risk profile from other investments in the firm, it would make sense to assess the cost of equity for the project independently. The only practical way of estimating betas and costs of equity for individual projects is the bottom-up beta approach.

## **Cost of Debt for Projects**

In the last chapter, we noted that the cost of debt for a firm should reflect its default risk. At the level of individual projects, the assessment of default risk becomes much more difficult, since projects seldom borrow on their own; most firms borrow money for all the projects that they undertake. There are three approaches to estimating the cost of debt for a project:

- One approach is based on the argument that since the borrowing is done by the firm rather than by individual projects, the cost of debt for a project should be the cost of debt for the firm considering the project. This approach makes the most sense when the projects being assessed are small relative to the firm taking them and thus have little or no appreciable effect on the firm's default risk.
- Look at the project's capacity to generate cash flows relative to its financing costs, and to estimate a default risk and cost of debt for the project. The most common approach used to estimate this default risk is to look at other firms that take similar projects, and use the typical default risk and cost of debt for these firms. This approach generally makes sense when the project is large in terms of its capital needs relative to the firm and has different cash flow characteristics

(both in terms of magnitude and volatility) from other investments taken by the firm.

• The third approach applies when a project actually borrows its own funds, with lenders having no recourse against the parent firm, in case the project defaults. While this is unusual, it can occur when investments have significant tangible assets of their own, and the investment is large relative to the firm considering it. In this case, the cost of debt for the project can be assessed using its capacity to generate cash flows relative to its financing obligations. In the last chapter, we used the bond rating of a firm to come up with the cost of debt for the firm. While projects may not be rated, we can still estimate a rating for a project based on financial ratios, and this rating can be used to estimate default risk and the cost of debt.

# **Financing Mix and Cost of Capital for Projects**

To get from the costs of debt and equity to the cost of capital, we have to weight each by their relative proportions in financing. Again, the task is much easier at the firm level, where we use the current market values of debt and equity to arrive at these weights. We may borrow money to fund a project, but it is often not clear whether we are using the debt capacity of the project or the firm's debt capacity. The solution to this problem will again vary depending upon the scenario we face.

- When we are estimating the financing weights for small projects that do not affect a firm's debt capacity, the financing weights should be those of the firm.
- When assessing the financing weights of large projects, with risk profiles different from that of the firm, we have to be more cautious. Using the firm's financing mix to compute the cost of capital for these projects can be misleading, since the project being analyzed may be riskier than the firm as a whole and thus incapable of carrying the firm's debt ratio. In this case, we would argue for the use of the average debt ratio of the other firms in the business in assessing the cost of capital of the project.
- The financing weights for stand-alone projects that are large enough to issue their own debt should be based upon the actual amounts borrowed by the projects. For

firms with such projects, the financing weights can vary from project to projects, as will the cost of debt.

In summary, the cost of debt and debt ratio for a project will reflect the magnitude of the project relative to the firm, and its risk profile, again relative to the firm. Table 5.1 summarizes our analyses:

Project Characteristics	Cost of Debt	Debt Ratio
Project is small and has	Firm's cost of debt	Firm's debt ratio
cash flow characteristics		
similar to the firm		
Project is large and has cash	Cost of debt of comparable	Average debt ratio of
flow characteristics	firms	comparable firms
different from the firm		
Stand-alone Project	Cost of debt for project	Debt ratio for project
	(based upon actual or	
	synthetic ratings)	

Table 5.1: Cost of Debt and Debt Ratio: Project Analyses

## Illustration 5.2: Estimating hurdle rates for individual projects

Using the principles of estimation laid out in the last few pages, we can estimate the hurdles rates for the three projects that we are analyzing in this chapter:

• Bookscape Online Information & Ordering Service: Since the beta and cost of equity that we estimated for Bookscape as a company reflect its status as a book store, we will re-estimate the beta for this online project by looking at publicly traded internet retailers. The unlevered total beta<sup>1</sup> of internet retailers is 4.20 and we assume that this project will be funded with the same mix of debt and equity (D/E=20.33%) that Bookscape uses in the rest of the business. We will also assume that Bookscape's tax rate of 40% and pre-tax cost of debt of 5.5% apply to this project as well.

<sup>&</sup>lt;sup>1</sup> The unlevered market beta for internet retailers is 2.10 and the average correlation of these stocks with the market is 0.50. The unlevered total beta is therefore 2.10/0.5 = 4.20.

Levered Beta for Online Service = 4.20 (1 + (1-.4) (.2033)) = 4.712Cost of Equity for Online Service = 4% + 4.712 (4.82%) = 26.71%Cost of Capital for Online Service = 26.71% (.831) + 5.5% (1-.4) (.169) = 22.76%

• *Disneyworld Bangkok*: We did estimate a cost of capital of 9.12% for the Disney theme park business in the last chapter, using a bottom-up levered beta of 1.0625 for the business. The only concern we would have with using this cost of capital for this project is that it may not adequately reflect the additional risk associated with the theme park being in an emerging market. To counter this risk, we compute the cost of equity for the theme park using a risk premium that includes a country risk premium for Thailand:<sup>2</sup>

Cost of Equity in US = 4% + 1.0625 (4.82% + 3.30%) = 12.63%

Cost of Capital in US \$ = 12.63% (.7898) + 3.29% (.2102) = 10.66%

Note that we have assumed that Disney will maintain its overall mix of debt and equity of 21.02% and its current after-tax cost of debt in funding this project.

• *Aracruz Paper Plant*: We estimated the cost of equity and capital for Aracruz's paper business in chapter 4 in real, U.S. dollar and nominal BR terms. In this chapter, we will use the real costs of equity and capital because our cash flows will be estimated in real terms as well:

Real Cost of Equity for Paper Business = 11.46% Real Cost of Capital for Paper Business = 9.00%

## In Practice: Exchange Rate Risk, Political Risk and Foreign Projects

When computing the cost of capital for the Disney Bangkok project, we adjusted the cost of capital for the additional risk associated with investing in Thailand. While it may seem obvious that an Thai investment will carry more risk for Disney than an investment in the United States, the question of whether discount rates should be adjusted for country risk is not an easy one to answer. It is true that a Thai investment will carry

 $<sup>^2</sup>$  We use the same approach we used to estimate the country risk premium for Brazil in the last chapter. The rating for Thailand is Baa1 and the default spread for the country bond is 1.50%. Multiplying this by the relative volatility of 2.2 of the equity market in Thailand (strandard deviation of equity/standard deviation of country bond) yields a country risk premium of 3.3%.

more risk for Disney than an investment in the United States, both because of exchange rate risk (the cashflows will be in Thai Baht and not in US dollars) and because of political risk (arising from Thailand's emerging market status). However, this risk should affect the discount rate only if it cannot be diversified away by the marginal investors in Disney.

In order to analyze whether the risk in Thaliand is diversifiable to Disney, we went back to our assessment of the marginal investors in the company in chapter 3, where we noted that they were primarily diversified institutional investors. Not only does exchange rate risk affect different companies in their portfolios very differently – some may be hurt by a strengthening dollar and others may be helped – but these investors can hedge exchange rate risk, if they so desire. If the only source of risk in the project were exchange rate, we would be inclined to treat it as diversifiable risk and not adjust the cost of capital. The issue of political risk is more confounding. To the extent that political risk is not only more difficult to hedge but also more likely to carry a non-diversifiable component, especially when we are considering risky emerging markets, the cost of capital should be adjusted to reflect it.

In short, whether we adjust the cost of capital for foreign projects will depend both upon the firm that is considering the project and the country in which the project is located. If the marginal investors in the firm are diversified and the project is in a country with relatively little or no political risk, we would be inclined not to add a risk premium on to the cost of capital. If the marginal investors in the firm are diversified and the project is in a country with significant political risk, we would add a political risk premium to the cost of capital. If the marginal investors in the firm are not diversified, we would adjust the discount rate for both exchange rate and political risk.

# **Measuring Returns: The Choices**

On all of the investment decisions described above, we have to choose between alternative approaches to measuring returns on the investment made. We will present our argument for return measurement in three steps. First, we will contrast accounting earnings and cash flows, and argue that cash flows are much better measures of true return on an investment. Second, we will note the differences between total cash flows and incremental cash flows and present the case for using incremental cash flows in measuring returns. Finally, we will argue that returns that occur earlier in a project life should be weighted more than returns that occur later in a project life, and that the return on an investment should be measured using time-weighted returns.

## A. Accounting Earnings versus Cash Flows

The first and most basic choice we have to make when it comes to measuring returns is the one between the accounting measure of income on a project - measured in accounting statements, using accounting principles and standards - and the cash flow generated by a project - measured as the difference between the cash inflows in each period and the cash outflows.

## Why are accounting earnings different from cashflows?

Accountants have invested substantial time and resources in coming up with ways of measuring the income made by a project. In doing so, they subscribe to some generally accepted accounting principles (GAAP). Generally accepted accounting principles require the recognition of revenues when the service for which the firm is getting paid has been performed in full or substantially, and has received in return either cash or a receivable that is both observable and measurable. For expenses that are directly linked to the production of revenues (like labor and materials), expenses are recognized in the same period in which revenues are recognized. Any expenses that are not directly linked to the production of revenues are recognized in the period in which the firm consumes the services. While the objective of distributing revenues and expenses fairly across time is a worthy one, the process of accrual accounting does create an accounting earnings number which can be very different from the cash flow generated by a project in any period. There are three significant factors that account for this difference.

## 1. Operating versus Capital Expenditure

Accountants draw a distinction between expenditures that yield benefits only in the immediate period or periods (such as labor and material for a manufacturing firm) and those that yield benefits over multiple periods (such as land, buildings and long-lived plant). The former are called <u>operating expenses</u> and are subtracted from revenues in computing the accounting income, while the latter are <u>capital expenditures</u> and are not subtracted from revenues in the period that they are made. Instead, the expenditure is spread over multiple periods and deducted as an expense in each period - these expenses are called depreciation (if the asset is a tangible asset like a building) or amortization (if the asset is an intangible asset like a patent or a trade mark).

While the capital expenditures made at the beginning of a project are often the largest and most prominent, many projects require capital expenditures during their lifetime. These capital expenditures will reduce the cash available in each of these periods.

# 5.1. <sup>(C)</sup>: What are research and development expenses?

Research and development expenses are generally considered to be operating expenses by accountants. Based upon our categorization of capital and operating expenses, would you consider research and development expenses to be

- a. operating expenses
- b. capital expenses
- *c*. could be operating or capital expenses, depending upon the type of research being done.
- Why?

## 2. Non-Cash Charges

The distinction that accountants draw between operating and capital expenses leads to a number of accounting expenses, such as depreciation and amortization, which are not cash expenses. These non-cash expenses, while depressing accounting income, do not reduce cash flows. In fact, they can have a significant positive impact on cash flows, if they affect the tax liability of the firm. Some non-cash charges reduce the taxable income and the taxes paid by a business. The most important of such charges is depreciation, which, while reducing taxable and net income, does not cause a cash outflow. Consequently, depreciation is added back to net income to arrive at the cash flows on a project.

For projects that generate large depreciation charges, a significant portion of the cash flows can be attributed to the tax benefits of depreciation, which can be written as follows

## Tax Benefit of Depreciation = Depreciation \* Marginal Tax Rate

While depreciation is similar to other tax deductible expenses in terms of the tax benefit it generates, its impact is more positive because it does not generate a concurrent cash outflow.

Amortization is also a non-cash charge, but the tax effects of amortization can vary depending upon the nature of the amortization. Some amortization, such as the amortization of the price paid for a patent or a trade mark, are tax deductible and reduce both accounting income and taxes. Thus, they provide tax benefits similar to depreciation. Other amortization, such as the amortization of the premium paid on an acquisition (called goodwill), reduces accounting income but not taxable income. This amortization does not provide a tax benefit.

While there are a number of different depreciation methods used by firms, they can be classified broadly into two groups. The first is <u>straight line depreciation</u>, whereby equal amounts of depreciation are claimed each period for the life of the project. The second group includes <u>accelerated depreciation methods</u> such as double-declining balance depreciation, which result in more depreciation early in the project life and less in the later years.

## 3. Accrual versus Cash Revenues and Expenses

The accrual system of accounting leads to revenues being recognized when the sale is made, rather than when the customer pays for the good or service. Consequently, accrual revenues may be very different from cash revenues for three reasons. First, some customers, who bought their goods and services in prior periods, may pay in this period; second, some customers who buy their goods and services in this period (and are therefore shown as part of revenues in this period) may defer payment until future periods. Finally, some customers who buy goods and services may never pay (bad debts). In some cases, customers may even pay in advance for products or services that will not be delivered until future periods.

A similar argument can be made on the expense side. Accrual expenses, relating to payments to third parties, will be different from cash expenses, because of payments made for material and services acquired in prior periods and because some materials and services acquired in current periods will not be paid for until future periods. Accrual taxes will be different from cash taxes for exactly the same reasons.

When material is used to produce a product or deliver a service, there is an added consideration. Some of the material that is used may have been acquired in previous periods and was brought in as inventory into this period, and some of the material that is acquired in this period may be taken into the next period as inventory.

Accountants define net working capital as the difference between current assets (such as inventory and accounts receivable) and current liabilities (such as accounts payable and taxes payable). Differences between accrual earnings and cash earnings, in the absence of non-cash charges, can be captured by changes in the net working capital.

# In Practice: The Payoff to Managing Working Capital

Firms that are more efficient in managing their working capital will see a direct payoff in terms of cash flows. Efficiency in working capital management implies that the firm has reduced its net working capital needs without adversely affecting its expected growth in revenues and earnings. Broadly defined, there are four ways in which net working capital can be reduced:

- While firms need to maintain an inventory to both produce goods and meet customer demand, minimizing this inventory while meeting these objectives can produce a lower net working capital. In fact, recent advances in technology which allow for just-in-time production have helped U.S. firms reduce their inventory needs significantly.
- Firms that sell goods and services on credit can reduce their net working capital needs by inducing customers to pay their bills faster, and by improving their collection procedures.
- 3. Firms can also look for suppliers who offer more generous credit terms since accounts payable can be used to finance inventory and accounts receivable.
- Firms that need cash for operational reasons can reduce their net working capital by keeping this cash balance to its minimum.

#### From Accounting Earnings to Cashflows

The three factors outlined above can cause accounting earnings to deviate significantly from the cash flows. To get from after-tax operating earnings, which measures the earnings to the firm, to cash flows to all investors in the firm, we have to

- Add back all non-cash charges, such as depreciation and amortization, to the operating earnings
- Subtract out all cash outflows that represent capital expenditures
- *Net out the effect of changes in non-cash working capital*, i.e. changes in accounts receivable, inventory and accounts payable. If non-cash working capital increased, the cash flows will be reduced by the change, whereas if it decreased, there is a cash inflow.

The first two adjustments adjust operating earnings to account for the distinction drawn by accountants between operating and capital expenditures, whereas the last adjustment converts accrual revenues and expenses into cash revenues and expenses.

Cash Flow to Firm = Earnings before interest and taxes (1-t) + Depreciation &

Amortization - Change in Non-cash Working Capital - Capital Expenditures The cash flow to the firm is a pre-debt, after-tax cash flow that measures the cash generated by a project for all claim holders in the firm, after reinvestment needs have been met.

To get from net income, which measures the earnings of equity investors in the firm, to cash flows to equity investors requires the additional step of considering the net cash flow created by repaying old debt and taking on new debt. The difference between new debt issues and debt repayments is called the net debt, and it has to be added back to arrive at cash flows to equity. In addition, other cash flows to non-equity claim holders in the firm, such as preferred dividends, have to be netted from cash flows.

Cash Flow to Equity = Net Income + Depreciation & Amortization - Change in Non-cash Working Capital - Capital Expenditures + (New Debt Issues – Debt Repayments) – Preferred Dividends

The cash flow to equity measures the cash flows generated by a project for equity investors in the firm, after taxes, debt payments and reinvestment needs.

# 5.2. 🖙 : Earnings and Cash Flows

If the earnings for a firm are positive, the cash flows will also be positive.

a. True

b. False

Why or why not?

#### **In Practice: Managing Earnings**

Companies, which have seen the effect on their stock prices of not meeting analyst expectations on earnings, have learned over the last decade to manage their earnings. Accounting standards, strict as they are for U.S. companies, still allow some leeway for firms to move earnings across periods by delaying revenues or expenses, or choosing a different accounting method. Companies like Microsoft not only work at holding down expectations on the part of analysts following them, but also use their growth and flexibility to move earnings across time to beat expectations. In January 1997, Microsoft reported earnings per share of 57 cents for the quarter, beating consensus estimates of 51 cents per quarter, the 41st quarter out of 42 that Microsoft had beaten expectations.

The phenomenon of managing earnings has profound implications for a number of actions that firms may take, from how they sell their products and services, to what kinds of projects they take or firms they acquire and how they account for such investments. While Microsoft has not been guilty of accounting manipulation and has worked strictly within the rules of the game, other companies which have tried to replicate its success have had to resort to far more questionable methods to report earnings that beat expectations.

#### The Case for Cash Flows

When earnings and cash flows are different, as they are for many projects, we must examine which one provides a more reliable measure of performance. We would argue that accounting earnings, especially at the equity level (net income), can be manipulated at least for individual periods, through the use of creative accounting techniques and strategic allocations. In a book, entitled <u>Accounting for Growth</u> which

won national headlines in the United Kingdom and cost the author his job, Terry Smith, an analyst at UBS Phillips & Drew, examined 12 legal accounting techniques commonly used to mislead investors about the profitability of individual firms. To show how creative accounting techniques can increase reported profits, Smith highlighted such companies as Maxwell Communications and Polly Peck, both of which eventually succumbed to bankruptcy.

The second reason for using cash flow is a much more direct one. No business that we know off accepts earnings as payment for goods and services delivered; all of them require cash. Thus, a project with positive earnings and negative cash flows will drain cash from the business undertaking it. Conversely, a project with negative earnings and positive cash flows might make the accounting bottom line look worse, but will generate cash for the business undertaking it.

## **B.** Total versus Incremental Cash Flows

The objective when analyzing a project is to answer the question: Will taking this project make the entire firm or business more valuable? Consequently, the cash flows we should look at in investment analysis are the cash flows the project creates for the firm or business considering it. We will call these cash flows incremental cash flows.

# Differences between Incremental and Total Cashflows

The total and the incremental cash flows on a project will generally be different for two reasons. The first is that some of the cash flows on an investment may have occurred already and therefore are unaffected by whether we take the investment or not. Such cash flows are titled sunk costs and should be removed from the analysis. The second is that some of the projected cash flows on any investment will be generated by the firm, whether this investment is accepted or rejected. Allocations of fixed expenses, such as general and administrative costs, usually fall into this category. These cash flows are not incremental and the analysis needs to be cleansed of their impact.

# 1. Sunk Costs

There are some expenses, related to a project that might be incurred before the project analysis is done. One example would be expenses associated with a test market done to assess the potential market for a product prior to conducting a full-blown investment analysis. Such expenses are called *sunk costs*. Since they will not be recovered if the project is rejected, sunk costs are not incremental and therefore should not be considered as part of the investment analysis. This contrasts with their treatment in accounting statements, that do not distinguish between expenses that have already been incurred and expenses which are still to be incurred.

One category of expenses that consistently falls into the sunk cost column in project analysis is research and development, which occurs well before a product is even considered for introduction. Firms that spend large amounts on research and development, such as Merck and Intel, have struggled to come to terms with the fact that the analysis of these expenses generally occur after the fact, when little can be done about them.

## In Practice: Who Will Pay The Sunk Costs?

While sunk costs should not be treated as part of investment analysis, a firm does need to cover its sunk costs over time or it will cease to exist. Consider, for example, a firm like McDonald's, which expends considerable resources in test marketing products before introducing them. Assume, on the ill-fated McLean Deluxe (the low-fat hamburger introduced in 1990), that the test market expenses amounted to \$30 million and that the net present value of the project, analyzed after the test market, amounted to \$20 million. The project should be taken. If this is the pattern for every project McDonald's takes on, however, it will collapse under the weight of its test marketing expenses. To be successful, the <u>cumulated</u> net present value of its successful projects will have to exceed the <u>cumulated</u> test marketing expenses on both its successful and unsuccessful products.

### 2. Allocated Costs

An accounting device created to ensure that every part of a business bears its fair share of costs is <u>allocation</u>, whereby costs that are not directly traceable to revenues generated by individual products or divisions are allocated across these units, based upon revenues, profits, or assets. While the purposes of such allocations may be rational, their effect on investment analyses have to be viewed in terms of whether they create "incremental" cash flows. An allocated cost that will exist with or without the project being analyzed does not belong in the investment analysis.

Any increase in administrative or staff costs that can be traced to the project is an incremental cost and belongs in the analysis. One way to estimate the incremental component of these costs is to break them down on the basis of whether they are fixed or variable, and, if they are variable, what they are a function of. Thus, a portion of administrative costs may be related to revenue, and the revenue projections of a new project can be used to estimate the administrative costs to be assigned to it.

#### Illustration 5.3: Dealing with Allocated Costs

<u>*Case 1*</u>: Assume that you are analyzing a project for a retail firm with general and administrative (G&A) costs currently of \$600,000 a year. The firm currently has five stores, and the new project will create a sixth division. The G & A Costs are allocated evenly across the stores; with five stores, the allocation to each store will be \$120,000. The firm is considering opening a new store; with six stores, the allocation of G & A expenses to each store will be \$100,000.

In this case, assigning a cost of \$100,000 for general and administrative costs to the new store in the investment analysis would be a mistake, since it is not an incremental cost — the total G& A cost will be \$600,000, whether the project is taken or not.

<u>*Case 2:*</u> In the analysis above, assume that all the facts remain unchanged except for one. The total general and administrative costs are expected to increase from \$600,000 to \$660,000 as a consequence of the new store. Each store is still allocated an equal amount; the new store will be allocated one-sixth of the total costs, or \$110,000.

In this case, the allocated cost of \$110,000 should not be considered in the investment analysis for the new store. The <u>incremental</u> cost of \$ 60,000 [\$660,000-\$600,000], however, should be considered as part of the analysis.

# In Practice: Who Will Pay For Headquarters?

As in the case of sunk costs, the right thing to do in project analysis (i.e., considering only direct incremental costs) may not add up to create a firm that is financially healthy. Thus, if a company like Disney does not require individual movies that it analyzes to cover the allocated costs of general administrative expenses of the

movie division, it is difficult to see how these costs will be covered at the level of the firm.

In 2003, Disney's corporate shared costs amounted to \$443 million. Assuming that these general administrative costs serve a purpose, which otherwise would have to be borne by each of Disney's business, and that there is a positive relationship between the magnitude of these costs and revenues, it seems reasonable to argue that the firm should estimate a fixed charge for these costs that every new investment has to cover, even though this cost may not occur immediately or as a direct consequence of the new investment.

### The Argument for Incremental Cash Flows

When analyzing investments it is easy to get tunnel vision and focus on the project or investment at hand, and to act as if the objective of the exercise is to maximize the value of the individual investment. There is also the tendency, with perfect hindsight, to require projects to cover all costs that they have generated for the firm, even if such costs will not be recovered by rejecting the project. The objective in investment analysis is to maximize the value of the business or firm taking the investment. Consequently, it is the cash flows that an investment will add on in the future to the business, i.e., the incremental cash flows, that we should focus on.

# Illustration 5.4: Estimating Cash Flows for an On-line Book Ordering Service: Bookscape

As described in illustration 5.1, Bookscape is considering an on-line book ordering and information service, which will be staffed by two full-time employees. The following estimates relate to the costs of starting the service and the subsequent revenues from it:

- The initial investment needed to start the service, including the installation of additional phone lines and computer equipment, will be \$ 1 million. These investments are expected to have a life of 4 years, at which point they will have no salvage value. The investments will be depreciated straight line over the 4-year life.
- The revenues in the first year are expected to be \$ 1.5 million, growing 20% in year 2, and 10% in the two years following.

- The salaries and other benefits for the employees is estimated to be \$150,000 in year
  1, and grow 10% a year for the following 3 years.
- 4. The cost of the books is assumed to be 60% of the revenues in each of the 4 years.
- 5. The working capital, which includes the inventory of books needed for the service and the accounts receivable (associated with selling books on credit) is expected to amount to 10% of the revenues; the investments in working capital have to be made at the beginning of each year. At the end of year 4, the entire working capital is assumed to be salvaged.
- The tax rate on income is expected to be 40%, which is also the marginal tax rate for Bookscape.

Based upon this information, we estimate the operating income for Bookscape Online in table 5.2:

	1	2	3	4
Revenues	\$1,500,000	\$1,800,000	\$1,980,000	\$2,178,000
Operating Expenses				
Labor	\$150,000	\$165,000	\$181,500	\$199,650
Materials	\$900,000	\$1,080,000	\$1,188,000	\$1,306,800
Depreciation	\$250,000	\$250,000	\$250,000	\$250,000
Operating Income	\$200,000	\$305,000	\$360,500	\$421,550
Taxes	\$80,000	\$122,000	\$144,200	\$168,620
After-tax Operating Income	\$120,000	\$183,000	\$216,300	\$252,930

Table 5.2: Expected Operating Income on Bookscape Online

To get from operating income to cash flows, we add back the depreciation charges and subtract out the working capital requirements (which are the changes in working capital from year to year). We also show the initial investment of \$ 1 million as a cash outflow right now (year 0) and the salvage value of the entire working capital investment in year 4.

0 (Now) 2 3 4 \$120,000 \$183,000 \$216,300 \$252,930 After-tax Operating Income + Depreciation \$250,000 \$250,000 \$250,000 \$250,000 - Change in Working Capital \$150,000 \$30,000 \$18,000 \$19,800 \$0 + Salvage Value \$217,800

Table 5.3: From Operating Income to After-tax Cashflows

21

After-tax Cashflows	-\$1,150,000	\$340,000	\$415,000	\$446,500	\$720,730
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Note that there is an initial investment in working capital, which is 10% of the first year's revenues, invested at the beginning of the year. Each subsequent year has a change in working capital that represents 10% of the revenue change from that year to the next.

# 5.4. **Provide State Stat**

In the analysis above, we assumed that Bookscape would have to maintain additional inventory for its on-line book service. If, instead, we had assumed that Bookscape could use its existing inventory (i.e., from its regular bookstore), the cash flows on this project

- *a.* will increase
- *b*. will decrease
- c. will remain unchanged

## Explain.

# Illustration 5.5: Estimating Incremental Cash Flows: Disney Theme Park

The theme parks to be built near Bangkok, modeled on Euro Disney in Paris, will include a "Magic Kingdom" to be constructed, beginning immediately, and becoming operational at the beginning of the second year, and a second theme park modeled on Epcot Center at Orlando to be constructed in the second and third year and becoming operational at the beginning of the fifth year. The following is the set of assumptions that underlie the investment analysis:

- The cash flows will be estimated in nominal dollars, even thought he actual cashflows will be in Thai baht.
- 2. The cost of constructing Magic Kingdom will be \$3 billion, with \$2 billion to be spent right now, and \$1 Billion to be spent one year from now. Disney has already spent \$0.5 Billion researching the proposal and getting the necessary licenses for the park; none of this investment can be recovered if the park is not built.
- 3. The cost of constructing Epcot II will be \$ 1.5 billion, with \$ 1 billion to be spent at the end of the second year and \$0.5 billion at the end of the third year.
- 4. The revenues at the two parks and the resort properties at the parks are assumed to be the following, based upon projected attendance figures until the tenth year and an

expected inflation rate of 2% (in US dollars). Starting in year 10, the revenues are expected to grow at the inflation rate. Table 5.4 summarizes the revenue projections:

Year	Magic Kingdom	Epcot II	<b>Resort Properties</b>	Total						
1	\$0	\$0	\$0	\$0						
2	\$1,000	\$0	\$250	\$1,250						
3	\$1,400	\$0	\$350	\$3,000						
4	\$1,700	\$300	\$500	\$4,250						
5	\$2,000	\$500	\$625	\$5,625						
6	\$2,200	\$550	\$688	\$6,563						
7	\$2,420	\$605	\$756	\$7,219						
8	\$2,662	\$666	\$832	\$7,941						
9	\$2,928	\$732	\$915	\$8,735						
10	\$2,987	\$747	\$933	\$9,242						
Beyond	Revenues grow 2% a year forever									

Table 5.4: Revenue Projections: Disney Bangkok

Note that the revenues at the resort properties are set at 25% of the revenues at the theme parks.

- 5. The operating expenses are assumed to be 60% of the revenues at the parks, and 75% of revenues at the resort properties.
- 6. The depreciation will be calculated as a percent of the remaining book value of the fixed assets at the end of each year. In addition, the parks will require capital maintenance investments each year, specified as a percent of the depreciation that year. Table 5.5 lists both these statistics by year:<sup>3</sup>

Year	Depreciation as % of book value	Capital Maintenance as % of /Depreciation
1	0.00%	0.00%
2	12.70%	50.00%
3	11.21%	60.00%
4	9.77%	70.00%
5	8.29%	80.00%
6	8.31%	90.00%
7	8.34%	100.00%
8	8.38%	105.00%

Table 5.5: Depreciation and Capital Maintenance Percentages

<sup>&</sup>lt;sup>3</sup> Capital maintenance expenditures are capital expenditures to replace fixed assets that break or become obsolete. An example would be the replacement of a ride at Magic Kingdom.

9	8.42%	110.00%
10	8.42%	110.00%

The capital maintenance expenditures are low in the early years, when the parks are still new but increase as the parks age. After year 10, both depreciation and capital expenditures are assumed to grow at the inflation rate (2%).

- 7. Disney will also allocate corporate general and administrative costs to this project, based upon revenues; the G&A allocation will be 15% of the revenues each year. It is worth noting that a recent analysis of these expenses found that only one-third of these expenses are variable (and a function of total revenue) and that two-thirds are fixed. After year 10, these expenses are also assumed to grow at the inflation rate of 2%.
- 8. Disney will have to maintain non-cash working capital (primarily consisting of inventory at the theme parks and the resort properties, netted against accounts payable) of 5% of revenues, with the investments being made at the *end of each year*.

9. The income from the investment will be taxed at Disney's marginal tax rate of 37.6%. The projected operating earnings at the theme parks, starting in the first year of operation (which is the second year) are summarized in Exhibit 5.1. Note that the project has no income or expenses until year 2 when the first park becomes operational and that the project is expected to have an operating loss of \$262 million in that year. We have assumed that the firm will have enough income in its other businesses to claim the tax benefits from these losses (37.3% of the loss) in the same year. If this had been a standalone project, we would have had to carry the losses forward into future years and reduce taxes in those years.

These operating earnings can be contrasted with the after-tax cash flows in exhibit 5.2, with the projected capital expenditures shown as part of the cash flows. In estimating these cash flows, we have made the following adjustments:

- Added back the depreciation and amortization each year, since it is a non-cash charge
- Subtracted out the maintenance capital expenditures in addition to the primary capital expenditures since these are cash outflows
- Added back the after-tax portion of the allocated general and administrative costs that are fixed and therefore not an incremental effect of the project.

After-tax Fixed Allocated G&A = (2/3) (Allocated G&A Expense) (1 - tax rate)

• Subtracted out the working capital requirements each year, which represent the change in working capital from the prior year. In this case, we have assumed that the working capital investments are made at the end of each year.

The investment of \$3 billion in Bangkok Magic Kingdom is shown at time 0 (as \$ 2 billion) and in year 1 (as \$ 1 billion). The investment of \$0.5 billion that will not be recovered because it has already been spent is not considered because it is a sunk cost.

## 5.5. S: Different Depreciation Methods for Tax Purposes and for Reporting

The depreciation that we used for the project above is assumed to be the same for both tax and reporting purposes. Assume now that Disney uses more accelerated depreciation methods for tax purposes and straight-line depreciation for reporting purposes. In estimating cash flows, we should use

a. the depreciation numbers from the tax books

*b*. the depreciation numbers from the reporting books Explain.

This spreadsheet allows you to estimate the cash flows to the firm on a project

	Now (0)	1	2	3	4	5	6	7	8	9	10
Magic Kingdom		\$0	\$1,000	\$1,400	\$1,700	\$2,000	\$2,200	\$2,420	\$2,662	\$2,928	\$2,987
Second Theme Park		\$0	\$0	\$0	\$300	\$500	\$550	\$605	\$666	\$732	\$747
Resort & Properties		\$0	\$250	\$350	\$500	\$625	\$688	\$756	\$832	\$915	\$933
Total Revenues			\$1,250	\$1,750	\$2,500	\$3,125	\$3,438	\$3,781	\$4,159	\$4,575	\$4,667
Magic Kingdom: Operating Expenses		\$0	\$600	\$840	\$1,020	\$1,200	\$1,320	\$1,452	\$1,597	\$1,757	\$1,792
Epcot II: Operating Expenses		\$0	\$0	\$0	\$180	\$300	\$330	\$363	\$399	\$439	\$448
Resort & Property: Operating Expenses	7	\$0	\$188	\$263	\$375	\$469	\$516	\$567	\$624	\$686	\$700
Depreciation & Amortization		\$0	\$537	\$508	\$430	\$359	\$357	\$358	\$361	\$366	\$369
Allocated G&A Costs		\$0	\$188	\$263	\$375	\$469	\$516	\$567	\$624	\$686	\$700
Operating Income		\$0	-\$262	-\$123	\$120	\$329	\$399	\$473	\$554	\$641	\$657
Taxes		\$0	-\$98	-\$46	\$45	\$123	\$149	\$177	\$206	\$239	\$245
Operating Income after Taxes			-\$164	-\$77	\$75	\$206	\$250	\$297	\$347	\$402	\$412
		Dej	preciatio	n Calcul	ations						
Pre-project investment	\$500										
New Investment – Magic Kingdom	\$2,000	\$1,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
New Investment - Epcot II	\$0	\$0	\$1,000	\$500	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Capital Maintenance		\$0	\$268	\$305	\$301	\$287	\$321	\$358	\$380	\$403	\$406
Depreciation as % of book value			12.5%	11%	9.5%	8%	8%	8%	8%	8%	8%
Depreciation		\$0	\$537	\$508	\$430	\$359	\$357	\$358	\$361	\$366	\$369
Book Value of Fixed Assets <sup>a</sup>	\$2,500	\$3,500	\$4,232	\$4,529	\$4,400	\$4,328	\$4,292	\$4,292	\$4,310	\$4,347	\$4,384

Exhibit 5.1: Operating Earnings at Disney Theme Parks in Bangkok

<sup>a</sup> Book value of fixed assets in year t = Book value of fixed assets in year t - 1 + New Cap Ex + Capital Maintenance - Depreciation

	Now (0)	1	2	3	4	5	6	7	8	9	10
Operating Income after Taxes			-\$165	-\$77	\$75	\$206	\$251	\$297	\$347	\$402	\$412
+ Depreciation & Amortization			\$537	\$508	\$430	\$359	\$357	\$358	\$361	\$366	\$369
- Capital Expenditures	\$2,000	\$1,000	\$1,269	\$805	\$301	\$287	\$321	\$358	\$379	\$403	\$406
- Change in Working Capital	\$0	\$0	\$63	\$25	\$38	\$31	\$16	\$17	\$19	\$21	\$5
+ Non-incremental Allocated Expense (1-t)		\$0	\$78	\$110	\$157	\$196	\$216	\$237	\$261	\$287	\$293
Cashflow to Firm	-\$2,000	-\$1,000	-\$880	-\$289	\$324	\$443	\$486	\$517	\$571	\$631	\$663

Exhibit 5.2: Operating Cash Flows at Disney Them Parks in Bangkok

Aracruz Cellulose is considering a plan to build a state-of-the-art plant to manufacture linerboard. The plant is expected to have a capacity of 750,000 tons and will have the following characteristics:

- 1. It will require an initial investment of 250 Million BR. At the end of the fifth year, an additional investment of 50 Million BR will be needed to update the plant.
- 2. Aracruz plans to borrow 100 Million BR, at a real interest rate of 5.25%, using a 10year term loan (where the loan will be paid off in equal annual increments).
- 3. The plant will have a life of 10 years. During that period, the plant (and the additional investment in year 5) will be depreciated using double declining balance depreciation, with a life of 10 years.<sup>4</sup> At the end of the tenth year, the plant is expected to be sold for its remaining book value.
- 4. The plant will be partly in commission in a couple of months, but will have a capacity of only 650,000 tons in the first year, 700,000 tons in the second year before getting to its full capacity of 750,000 tons in the third year.
- 5. The capacity utilization rate will be 90% for the first 3 years, and rise to 95% after that.
- 6. The price per ton of linerboard is currently \$400, and is expected to keep pace with inflation for the life of the plant.
- 7. The variable cost of production, primarily labor and material, is expected to be 55% of total revenues; there is a fixed cost of 50 Million BR, which will grow at the inflation rate.
- 8. The working capital requirements are estimated to be 15% of total revenues, and the investments have to be made at the beginning of each year. At the end of the tenth year, it is anticipated that the entire working capital will be salvaged.

<sup>&</sup>lt;sup>4</sup> With double declining balance depreciation, we double the straight line rate (which would be 10% a year in this case with a 10-year life) and apply that rate to the remaining book value. We apply this rate to the investment in year 5 as well.

Before we estimate the net income on this project, we have to consider the debt payments each year and break them down into interest and principal payments. Table 5.6 summarizes the results:

Year	Beginning Debt	Interest expense	Principal Repaid	Total Payment	Ending Debt
1	R\$ 100,000	R\$ 5,250	R\$ 7,858	R\$ 13,108	R\$ 92,142
2	R\$ 92,142	R\$ 4,837	R\$ 8,271	R\$ 13,108	R\$ 83,871
3	R\$ 83,871	R\$ 4,403	R\$ 8,705	R\$ 13,108	R\$ 75,166
4	R\$ 75,166	R\$ 3,946	R\$ 9,162	R\$ 13,108	R\$ 66,004
5	R\$ 66,004	R\$ 3,465	R\$ 9,643	R\$ 13,108	R\$ 56,361
6	R\$ 56,361	R\$ 2,959	R\$ 10,149	R\$ 13,108	R\$ 46,212
7	R\$ 46,212	R\$ 2,426	R\$ 10,682	R\$ 13,108	R\$ 35,530
8	R\$ 35,530	R\$ 1,865	R\$ 11,243	R\$ 13,108	R\$ 24,287
9	R\$ 24,287	R\$ 1,275	R\$ 11,833	R\$ 13,108	R\$ 12,454
10	R\$ 12,454	R\$ 654	R\$ 12,454	R\$ 13,108	R\$ 0

Table 5.6: Debt Payments – Aracruz Paper Plant

Note that while the total payment remains unchanged, the break down into interest and principal payments changes from year to year.

Exhibit 5.3 summarizes the net income from plant investment to Aracruz each year for the next 10 years. Note that all of the projections are in real cashflows. Consequently, the price of paper (which grows at the same rate as inflation) is kept constant in real terms, as is any other item having this characteristic.

In Exhibit 5.4 we estimate the cash flows to equity from the plant to Aracruz. To arrive at these cash flows, we do the following:

- Subtract out the portion of the initial capital expenditures that comes from equity; of the initial investment of 250,000 BR, only 150,000 BR comes from equity. In year 5, there is an additional investment of 50,000 BR.
- Add back depreciation and amortization, since they are non-cash charges.
- Subtract the changes in working capital; since investments in working capital are made at the beginning of each period, the initial investment in working capital of 35.1 million BR is made at time 0 and is 15% of revenues in year 1. The changes in working capital in the years that follow are 15% of the changes in revenue in those years. At the end of year 10, the entire investment in working capital is recovered as salvage.

- Subtract the principal payments that are made to the bank in each period, since these are cash outflows to the non-equity claimholders in the firm.
- Add the salvage value of the plant in year 10 to the total cash flows, since this is a cash inflow to equity investors.

The cash flows to equity measure the cash flows that equity investors at Aracruz can expect to receive from investing in the plant.

# 5.6. S: The Effects of Debt Financing on Cashflows to Equity

In the analysis above, we assumed an additional capital expenditure of 50 Million BR in year 5, financed entirely with funds from equity; the cash flow to equity in year 5 (from exhibit 5.4) is -5,411 Million BR. If, instead, we had assumed the 50 Million BR had come from new borrowing, the cash flow to equity in year 5

*a.* will increase by 50 Million BR

- b. will decrease by 50 Million BR
- c. will remain unchanged

Explain.

This spreadsheet allows you to estimate the cash flows to equity on a project

	1	2	3	4	5	6	7	8	9	10
Capacity (in '000s)	650	700	750	750	750	750	750	750	750	750
Utilization Rate	90%	90%	90%	95%	95%	95%	95%	95%	95%	95%
Production	585	630	675	713	713	713	713	713	713	713
Price per ton	400	400	400	400	400	400	400	400	400	400
Revenues	234,000	252,000	270,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000
Operating										
Expenses	178,700	188,600	198,500	206,750	206,750	206,750	206,750	206,750	206,750	206,750
Depreciation	35,000	28,000	22,400	17,920	14,336	21,469	21,469	21,469	21,469	21,469
Operating Income	20,300	35,400	49,100	60,330	63,914	56,781	56,781	56,781	56,781	56,781
- Interest	5,250	4,837	4,403	3,946	3,465	2,959	2,426	1,865	1,275	654
Taxable Income	15,050	30,563	44,697	56,384	60,449	53,822	54,355	54,916	55,506	56,127
- Taxes	5,117	10,391	15,197	19,170	20,553	18,300	18,481	18,671	18,872	19,083
Net Income	9,933	20,171	29,500	37,213	39,896	35,523	35,874	36,244	36,634	37,044
Beg. Book Value	250,000	215,000	187,000	164,600	146,680	182,344	160,875	139,406	117,938	96,469
- Depreciation <sup>a</sup>	35,000	28,000	22,400	17,920	14,336	21,469	21,469	21,469	21,469	21,469
End Book Value	215,000	187,000	164,600	146,680	182,344	160,875	139,406	117,938	96,469	75,000

Exhibit 5.3: Estimated Net Income from Paper Plant Investment: Aracruz Cellulose

<sup>a</sup>Depreciation is 20% of depreciable value (Remaining book value – Salvage) until year 6. In year 6, we switch to straight line for the remaining depreciable value over the remaining life because it yields a higher depreciation (\$11,469). We also depreciate the second investment in year 5 straight line over 5 years.

	0	1	2	3	4	5	6	7	8	9	10
Net Income		9,933	20,171	29,500	37,213	39,896	35,523	35,874	36,244 BR	36,634 BR	37,044 BR
+ Depreciation &											
Amortization		35,000	28,000	22,400	17,920	14,336	21,469	21,469	21,469	21,469	21,469
- Capital Expenditures	150,000	0	0	0	0	50,000	0	0	0	0	0
- Change in Working											
Capital	35,100	2,700	2,700	2,250	0	0	0	0	0	0	
- Principal Repayments		7,858	8,271	8,705	9,162	9,643	10,149	10,682	11,243	11,833	12,454
+ Salvage Value of Assets <sup>b</sup>											117,750
Cashflow to Equity	(185,100)	34,375	37,201	40,945	45,971	(5,411)	46,842	46,661	46,470	46,270	163,809

Exhibit 5.4: Cash Flows to Equity from Paper Plant: Aracruz Cellulose

<sup>b</sup>Salvage Value of Assets = Salvage value of Plant and Equipment (75,000) + Salvage value of working capital (42,750)

#### In Practice: Estimating Expected Revenues and Cash flows

How do we estimate a project's expected revenues and expenses? The key word in this question is "estimate". No one, no matter what his or her skill at forecasting and degree of preparation, can forecast with certainty how a project will do. There are generally three ways in which we can make these forecasts:

- a. Experience and History: The process of estimating project revenues and expenses is simplest for firms that consider the same kind of projects repeatedly. These firms can use their experience from similar projects that are already in operation to estimate expected values for new projects. Disney, for instance, can use its experiences with its theme parks in the United States, Tokyo Disney and Euro Disney in making its estimates for Disney Bangkok.
- b. Market Testing: If the project being assessed is different from the firm's existing business, we may need a preliminary assessment of the market before actually investing in the project. In a market survey, potential customers are asked about the product or service being considered, to gauge the interest they would have in acquiring it. The results usually are qualitative and indicate whether the interest is strong or weak, allowing the firm to then decide whether to use optimistic forecasts for revenues (if the interest is strong) or pessimistic forecasts (if the interest is weak). Companies that need more information will often test market the concept on smaller markets, before introducing it on a larger scale. Test marketing not only allows firms to test out the product or service directly, but also yields far more detailed information about the potential size of the market.
- c. Scenario Analysis: There are cases in which a firm is considering introducing a product to a market it knows well, but there is considerable uncertainty introduced by external factors that the firm cannot control. In such cases, a firm may decide to consider different scenarios, and the revenues and expenses on the project under each scenario. While the concept is a simple one, it has four critical components. The first is the determination of which factors the scenarios will be built around. The second component is determining the number of scenarios to analyze for each factor. While more scenarios may be more realistic than fewer, it becomes more difficult to collect information and differentiate between the scenarios in terms of project revenues. The

third component is the estimation of project revenues and expenses under each scenario. The final component is the assignment of probabilities to each scenario.While we have laid out three ways of estimating revenues and expenses for projects, none of these approaches yields perfect estimates. While some project risk may come from estimation error, a large portion of risk comes from real uncertainty about the future. Improving estimation techniques, using more market testing and doing scenario analysis may reduce estimation error but cannot eliminate real uncertainty. This is why we incorporate a risk premium into the discount rate.

## C. Time-Weighted versus Nominal Cash Flows

Very few projects with long lifetimes generate earnings or cash flows evenly over their life. In sectors with huge investments in infra structure, such as telecommunications, the earnings and cash flows might be negative for an extended period (say ten to twenty years) before they turn positive. In other sectors, the earnings may occur earlier in time. Whatever the reason for the unevenness of cash flows, a basic question that has to be addressed when measuring returns is whether they should reflect the timing of the earnings or cash flows. We will argue that they should, with earlier earnings and cash flows being weighted more than earnings and cash flows later in a project life.

#### Why cash flows across time are not comparable

There are three reasons why cash flows across time are not comparable, and a cash flow in the future is worth less than a similar cash flow today:

- (1) Individuals prefer present consumption to future consumption. People would have to be offered more in the future to give up present consumption - this is called the <u>real rate</u> <u>of return</u>. The greater the real rate of return, the greater will be the difference in value between a cash flow today and an equal cash flow in the future.
- (2) When there is <u>monetary inflation</u>, the value of currency decreases over time. The greater the inflation, the greater the difference in value between a cash flow today and a cash flow in the future.
- (3) Any <u>uncertainty (risk)</u> associated with the cash flow in the future reduces the value of the cashflow. The greater the uncertainty associated with the cash flow, the greater will

be the difference between receiving the cash flow today and receiving an equal amount in the future.

The process by which future cash flows are adjusted to reflect these factors is called <u>discounting</u>, and the magnitude of these factors is reflected in the <u>discount rate</u>. Thus the present value of a cash flow ( $CF_t$ ) at a point in time 't' in the future, when the discount rate is r, can be written as follows:

Present Value of Cash Flow = 
$$CF_t\left(\frac{1}{(1+r)^t}\right)$$

Note that the second term in the brackets  $\left(\frac{1}{(1+r)^t}\right)$  is called the discount factor and

effectively weights the cash flow by when it occurs. The differences in weights across time will depend entirely upon the level of the discount rate. Consequently, when discount rates are high, which could be due to high real rates, high inflation and/or high uncertainty, returns that occur further in the future will be weighted less. Appendix 1 includes a more complete discussion of the mechanics of present value.

#### The Case for Time-weighted Returns

If we accept the arguments that cash flows measure returns more accurately than earnings, and that the incremental cash flows more precisely estimate returns than total cash flows, we should logically follow up by using discounted cash flows (i.e., timeweighted returns) rather than nominal cash flows for two reasons.

- Nominal cash flows at different points in time are not comparable, and cannot be aggregated to arrive at returns. Discounted cash flows, on the other hand, convert all cash flows on a project to today's terms and allow us to compute returns more consistently.
- If the objective in investment analysis is to maximize the value of the business taking the investments, we should be weighting cash flows that occur early more than cash flow that occur later, because investors in the business will also do so.

# 5.7. **B**: Time Horizons and Time Weighting

Calculating present values for cash flows leads to a greater weighting for cash flows that occur sooner and a lower weighting for cash flows that occur later. Does it necessarily

follow that using present value (as opposed to nominal value) makes managers more likely to take short-term projects over long term projects?

a. Yes

b. No

Why or why not?

# **Investment Decision Rules**

Having estimated the accounting earnings, cashflows and time-weighted cashflows on an investment, we are still faced with the crucial decision of whether we should take the investment or not. In this section, we will consider a series of investment decision rules and put them to the test.

### What is an investment decision rule?

When faced with new investments and projects, firms have to decide whether to invest in them or not. While we have been leading up to this decision over the last few chapters, investment decision rules allow us to formalize the process and specify what condition or conditions need to be met for a project to be acceptable. While we will be looking at a variety of investment decision rules in this section, it is worth keeping in mind what characteristics we would like a good investment decision rule to have.

- First, a good investment decision rule has to maintain a fair balance between allowing a manager analyzing a project to bring in his or her *subjective assessments* into the decision, and ensuring that different projects are judged *consistently*. Thus, an investment decision rule that is too mechanical (by not allowing for subjective inputs) or too malleable (where managers can bend the rule to match their biases) is not a good rule.
- Second, a good investment decision rule will allow the firm to further our stated objective in corporate finance, which is to *maximize the value of the firm*. Projects that are acceptable, using the decision rule, should increase the value of the firm accepting them, while projects that do not meet the requirements would destroy value if the firm invested in them.
- Third, a good investment decision rule should *work across a variety of investments*. Investments can be revenue-generating investments (such as the Home Depot opening
a new store) or they can be cost saving investments (as would be the case if Boeing adopted a new system to manage inventory). Some projects have large up-front costs (as is the case with the Boeing Super Jumbo), while other projects may have costs spread out across time. A good investment rule will provide an answer on all of these different kinds of investments.

Does there have to be only one investment decision rule? While many firms analyze projects using a number of different investment decision rules, one rule has to dominate. In other words, when the investment decision rules lead to different conclusions on whether the project should be accepted or rejected, one decision rule has to be the tie-breaker and can be viewed as the primary rule.

## **Accounting Income Based Decision Rules**

Many of the oldest and most established investment decision rules have been drawn from the accounting statements and, in particular, from accounting measures of income. Some of these rules are based on income to equity investors (i.e., net income) while others are based on pre-debt operating income.

## Return on Capital

The return on capital on a project measures the returns earned by the firm on it is total investment in the project. Consequently, it is a return to all claimholders in the firm on their collective investment in a project. Defined generally,

Return on Capital (Pre-tax) = 
$$\frac{\text{Earnings before interest and taxes}}{\text{Average Book Value of Total Investment in Project}}$$
  
Return on Capital (After-tax) = 
$$\frac{\text{Earnings before interest and taxes (1- tax rate)}}{\text{Average Book Value of Total Investment in Project}}$$

To illustrate, consider a 1-year project, with an initial investment of \$ 1 million, and earnings before interest and taxes of \$300,000. Assume that the project has a salvage value at the end of the year of \$800,000, and that the tax rate is 40%. In terms of a time line, the project has the following parameters:



The pre-tax and after-tax returns on capital can be estimated as follows:

Return on Capital (Pre-tax) = 
$$\frac{\$ 300,000}{\$ 900,000}$$
 = 33.33%  
Return on Capital (After-tax) =  $\frac{\$ 300,000 (1 - 0.40)}{\$ 900,000}$  = 20%

While this calculation is rather straightforward for a 1-year project, it becomes more involved for multi-year projects, where both the operating income and the book value of the investment change over time. In these cases, the return on capital can either be estimated each year and then averaged over time or the average operating income over the life of the project can be used in conjunction with the average investment during the period to estimate the average return on capital.

The after-tax return on capital on a project has to be compared to a hurdle rate that is defined consistently. The return on capital is estimated using the earnings before debt payments and the total capital invested in a project. Consequently, it can be viewed as return to the firm, rather than just to equity investors. Consequently, the cost of capital should be used as the hurdle rate.

If the after-tax return on capital > Cost of Capital -> Accept the project

If the after-tax return on capital < Cost of Capital -> Reject the project For instance, if Disney in the example, above, had a cost of capital of 10%, it would view the investment in the new software as a good one.

# Illustration 5.7: Estimating and Using Return on Capital in Decision Making: Disney and Bookscape

In illustration 5.4 and 5.5, we estimated the operating income from two projects an investment by Bookscape in an on-line book ordering service and an investment in a theme park in Bangkok by Disney. We will estimate the return on capital on each of these investments using these estimates of operating income. Table 5.7 summarizes the estimates of operating income and the book value of capital at Bookscape.

	1	2	3	4	Average
After-tax Operating Income	\$120,000	\$183,000	\$216,300	\$252,930	\$193,058
BV of Capital: Beginning	\$1,150,000	\$930,000	\$698,000	\$467,800	
BV of Capital: Ending	\$930,000	\$698,000	\$467,800	\$0	
Average BV of Capital	\$1,040,000	\$814,000	\$582,900	\$233,900	\$667,700
Return on Capital	11.54%	22.48%	37.11%	108.14%	28.91%

Table 5.7: Return on Capital on Bookscape On-line

The book value of capital each year includes the investment in fixed assets and the noncash working capital. If we average the year-specific returns on capital, the average return on capital is 44.82% but this number is pushed up by the extremely high return in year 4. A better estimate of the return on capital is obtained by dividing the average aftertax operating income over the four years by the average capital invested over the four years, which yields a return on capital of 28.91%. Since this exceeds the cost of capital that we estimated in illustration 5.2 for this project of 22.76%, the return on capital approach would suggest that this is a good project.

In table 5.8, we estimate operating income, book value of capital and return on capital for Disney's theme park investment in Thailand. The operating income estimates are from exhibit 5.1:

	After-tax				
	Operating	BV of Capital:	BV of Capital:	Average BV	
Year	Income	Beginning	Ending	of Capital	ROC
1	\$0	\$2,500	\$3,500	\$3,000	NA
2	-\$165	\$3,500	\$4,294	\$3,897	-4.22%
3	-\$77	\$4,294	\$4,616	\$4,455	-1.73%
4	\$75	\$4,616	\$4,524	\$4,570	1.65%
5	\$206	\$4,524	\$4,484	\$4,504	4.58%
6	\$251	\$4,484	\$4,464	\$4,474	5.60%
7	\$297	\$4,464	\$4,481	\$4,472	6.64%
8	\$347	\$4,481	\$4,518	\$4,499	7.72%
9	\$402	\$4,518	\$4,575	\$4,547	8.83%
10	\$412	\$4,575	\$4,617	\$4,596	8.97%
	\$175			\$4,301	4.23%

Table 5.8: Return on Capital for Disney Theme Park Investment

The book value of capital includes the investment in fixed assets (capital expenditures), net of depreciation, and the investment in working capital that year and the return on capital each year is computed based upon the average book value of capital invested during the year. The average after-tax return on capital over the 10-year period is 4.21%. Here, the return on capital is lower than the cost of capital that we estimated in illustration 5.2 to be 10.66% and this suggests that Disney should not make this investment.

# Return on Equity

The return on equity looks at the return to equity investors, using the accounting net income as a measure of this return. Again, defined generally,

Return on Equity = 
$$\frac{\text{Net Income}}{\text{Average Book Value of Equity Investment in Project}}$$
  
To illustrate, consider a 4-year project with an initial equity investment of \$ 800, and the

following estimates of net income in each of the 4 years:



Like the return on capital, the return on equity tends to increase over the life of the project, as the book value of equity in the project is depreciated.

Just as the appropriate comparison for the return on capital is the cost of capital, the appropriate comparison for the return on equity is the <u>cost of equity</u>, which is the rate of return equity investors demand.

Decision Rule for ROE Measure for Independent Projects					
If the Return on Equity > Cost of Equity	->	Accept the project			
If the Return on Equity < Cost of Equity	->	Reject the project			

The cost of equity should reflect the riskiness of the project being considered and the financial leverage taken on by the firm. When choosing between mutually exclusive projects of similar risk, the project with the higher return on equity will be viewed as the better project.

## Illustration 5.8: Estimating Return on Equity - Aracruz Cellulose

Consider again the analysis of the paper plant for Aracruz Cellulose that we started in illustration 5.6. Table 5.9 summarizes the book value of equity and the estimated net income (from exhibit 5.3) for each of the next ten years in thousands of real BR.

		Beg.			Ending	BV of			Average	
	Net	BV:		Capital	BV:	Working		BV:	BV:	
Year	Income	Assets	Depreciation	Exp.	Assets	Capital	Debt	Equity	Equity	ROE
0		0	0	250,000	250,000	35,100	100,000	185,100		
1	9,933	250,000	35,000	0	215,000	37,800	92,142	160,658	172,879	5.75%
2	20,171	215,000	28,000	0	187,000	40,500	83,871	143,629	152,144	13.26%
3	29,500	187,000	22,400	0	164,600	42,750	75,166	132,184	137,906	21.39%
4	37,213	164,600	17,920	0	146,680	42,750	66,004	123,426	127,805	29.12%
5	39,896	146,680	14,336	50,000	182,344	42,750	56,361	168,733	146,079	27.31%
6	35,523	182,344	21,469	0	160,875	42,750	46,212	157,413	163,073	21.78%
7	35,874	160,875	21,469	0	139,406	42,750	35,530	146,626	152,020	23.60%
8	36,244	139,406	21,469	0	117,938	42,750	24,287	136,400	141,513	25.61%
9	36,634	117,938	21,469	0	96,469	42,750	12,454	126,764	131,582	27.84%
10	37,044	96,469	21,469	0	75,000	0	0	75,000	100,882	36.72%
										23.24%

Table 5.9: Return on Equity: Aracruz Paper Plant

To compute the book value of equity in each year, we first compute the book value of the fixed assets (plant and equipment), add to it the book value of the working capital in that year and subtract out the outstanding debt. The return on equity each year is obtained by dividing the net income in that year by the average book value of equity invested in the plant in that year. The increase in the return on equity over time occurs because the net income rises, while the book value of equity decreases. The average real return on equity of 22.91% on the paper plant project is compared to the real cost of equity for this plant, which is 11.40%, suggesting that this is a good investment.

## Assessing Accounting Return Approaches

How well do accounting returns measure up to the three criteria that we listed for a good investment decision rule? In terms of maintaining balance between allowing managers to bring into the analysis their judgments about the project and ensuring consistency between analysis, the accounting returns approach falls short. It fails because it is significantly affected by accounting choices. For instance, changing from straight line to accelerated depreciation affects both the earnings and the book value over time, thus altering returns. Unless these decisions are taken out of the hands of individual managers assessing projects, there will be no consistency in the way returns are measured on different projects.

Does investing in projects that earn accounting returns exceeding their hurdle rates lead to an increase in firm value? The value of a firm is the present value of expected cash flows on the firm over its lifetime. Since accounting returns are based upon earnings, rather than cash flows, and ignore the time value of money, investing in projects that earn a return greater than the hurdle rates will not necessarily increase firm value. Conversely, some projects that are rejected because their accounting returns fall short of the hurdle rate may have increased firm value. This problem is compounded by the fact that the returns are based upon the book value of investments, rather than the cash invested in the assets.

Finally, the accounting return works better for projects that have a large up-front investment and generate income over time. For projects that do not require a significant initial investment, the return on capital and equity has less meaning. For instance, a retail firm that leases store space for a new store will not have a significant initial investment, and may have a very high return on capital as a consequence.

Note that all of the limitations of the accounting return measures are visible in the last two illustrations. First, the Disney example does not differentiate between money already spent and money still to be spent; rather, the sunk cost of \$ 0.5 billion is shown in the initial investment of \$3.5 billion. Second, in both the Bookscape and Aracruz analyses, as the book value of the assets decreases over time, largely as a consequence of depreciation, the operating income rises, leading to an increase in the return on capital. With the Disney analysis, there is one final and very important concern. The return on

capital was estimated over 10 years but the project life is likely to be much longer. After all, Disney's existing theme parks in the United States are more than three decades old and generate substantial cashflows for the firm still. Extending the project life will push up the return on capital and may make this project viable.

Notwithstanding these concerns, accounting measures of return endure in investment analysis. While this fact can be partly attributed to the unwillingness of financial managers to abandon familiar measures, it also reflects the simplicity and intuitive appeal of these measures. More importantly, as long as accounting measures of return are used by investors and equity research analysts to assess to overall performance of firms, these same measures of return will be used in project analysis.

*capbudg.xls*: This spreadsheet allows you to estimate the average return on capital on a project

## **Returns on Capital and Equity for Entire Firms**

The discussion of returns on equity and capital has so far revolved around individual projects. It is possible, however, to calculate the return on equity or capital for an entire firm, based upon its current earnings and book value. The computation parallels the estimation for individual projects but uses the values for the entire firm:

Return on Capital (ROC or ROIC) = 
$$\frac{EBT(1-t)}{(Book Value of Debt + Book Value of Equity)}$$
  
Return on Equity = 
$$\frac{Net Income}{Book Value of Equity}$$

We use book value rather than market value because it represents the investment (at least as measured by investments) in existing investments. This return can be used as an approximate measure of the returns that the firm is making on its existing investments or assets, as long as the following assumptions hold:

 The income used (operating or net) is income derived from existing projects and is not skewed by expenditures designed to provide future growth (such as R&D expenses) or one-time gains or losses.  More importantly, the book value of the assets used measures the actual investment that the firm has in these assets. Here again, stock buybacks and goodwill amortization can create serious distortions in the book value.<sup>5</sup>

3. The depreciation and other non-cash charges that usually depress income are used to make capital expenditures that maintain the existing asset's income earning potential. If these assumptions hold, the return on capital becomes a reasonable proxy for what the firm is making on its existing investments or projects, and the return on equity becomes a proxy for what the equity investors are making on their share of these investments.

With this reasoning, a firm that earns a return on capital that exceeds it cost of capital can be viewed as having, on average, good projects on its books. Conversely, a firm that earns a return on capital that is less than the cost of capital can be viewed as having, on average, bad projects on its books. From the equity standpoint, a firm that earns a return on equity that exceeds its cost of equity can be viewed as earnings "surplus returns" for its stockholders, while a firm that does not accomplish this is taking on projects that destroy stockholder value.

#### Illustration 5.9: Evaluating Current Investments

In table 5.10, we have summarized the current returns on capital and costs of capital for Disney, Aracruz and Bookscape. The book values of debt and equity at the beginning of the year (2003) were added together to compute the book value of capital invested, and the operating income for the most recent financial year (2003) is used to compute the return on capital.<sup>6</sup> Considering the issues associated with measuring debt and cost of capital for financial services firms, we have not computed the values for Deutsche Bank:

<sup>&</sup>lt;sup>5</sup> Stock buybacks and large write offs will push down book capital and result in overstated accounting returns. Acquisitions that create large amounts of goodwill will push up book capital and result in understated returns on capital.

<sup>&</sup>lt;sup>6</sup> Some analysts use average capital invested over the year, obtained by averaging the book value of capital at the beginning and end of the year. By using the capital invested at the beginning of the year, we have assumed that capital invested during the course of year is unlikely to generate operating income during that year.

							ROC -
	EBIT (1-	BV of	BV of	BV of	Return on	Cost of	Cost of
Company	<i>t</i> )	Debt	Equity	Capital	Capital	Capital	Capital
Disney	\$1701	14130	23879	38009	4.48%	8.59%	-4.12%
Aracruz	BR 586	2862	6385	9248	6.34%	9.00%	-2.66%
Bookscape	\$ 1200	0	4500	4500	26.67%	12.14%	14.53%

Table 5.10: Return on Capital and Cost of Capital Comparison

The marginal tax rates used in chapter 4 are used here as well. While this analysis suggests that only Bookscape is earning excess returns, the following factors should be considered:

- The book value of capital is affected fairly dramatically by accounting decisions. In particular, Disney's capital invested increased by almost \$20 billion from 1995 to 1996 as a result of the acquisition of Capital Cities, and Disney's decision to use purchase accounting. If they had chosen pooling instead, they would have reported a return on capital that exceeded their cost of capital by a healthy amount.
- 2. We have used the operating income from the most recent year, notwithstanding the volatility in the income. To smooth out the volatility, we can compute the average operating income over the last 3 years and use it in computing the return on capital; this approach generates a "normalized" return on capital of 4.36% for Disney and 3.40% for Aracruz. Both are still below the cost of capital.
- 3. We did not adjust the operating income or the book value of capital to include operating leases that were outstanding at the end of the prior year. If we had made the adjustment for Disney and Bookscape, the returns on capital would have changed to 4.42% and 12.78% respectively.<sup>7</sup>
- 4. For Aracruz, we are assuming that since the book values are adjusted for inflation, the return on capital is a real return on capital and can be compared to the real cost of capital.<sup>8</sup>

<sup>&</sup>lt;sup>7</sup> To adjust the operating income, we add back the operating lease expense from the most recent year and subtract out the depreciation on the operating lease asset. To adjust the book value of capital, we add the present value of operating leases at the end of the previous year to debt.

<sup>&</sup>lt;sup>8</sup> Brazilian accounting standards allow for the adjustment of book value for inflation.

The analysis can also be done in purely equity terms. To do this, we would first compute the return on equity for each company by dividing the net income for the most recent year by the book value of equity at the beginning of the year and compare it to the cost of equity. Table 5.11 summarizes these results:

					ROE - Cost of
Company	Net Income	BV of Equity	ROE	Cost of Equity	Equity
Disney	1267	23879	5.31%	10.00%	-4.70%
Aracruz	428	6385	6.70%	10.79%	-4.09%
Bookscape	1320	4500	29.33%	13.93%	15.40%
Deutsche Bank	1365	29991	4.55%	8.76%	-4.21%

 Table 5.11: Return on Equity and Cost of Equity Comparisons

The conclusions are similar, with Bookscape earning excess returns, whereas the other companies all have returns that lag the cost of equity.



There is a dataset on the web that summarizes, by sector, returns on equity and capital as well as costs of equity and capital.

# In Practice: Economic Value Added (EVA)

Economic value added is a value enhancement concept that has caught the attention of both firms interested in increasing their value and portfolio managers, looking for good investments. EVA is a measure of dollar surplus value created by a firm or project and is measured by doing the following:

Economic Value Added (EVA) = (Return on Capital - Cost of Capital) (Capital Invested) The return on capital is measured using "adjusted" operating income, where the adjustments<sup>9</sup> eliminate items that are unrelated to existing investments, and the capital investment is based upon the book value of capital, but is designed to measure the capital invested in existing assets. Firms that have positive EVA are firms that are creating surplus value, and firms with negative EVA are destroying value.

<sup>&</sup>lt;sup>9</sup> Stern Stewart, which is the primary proponent of the EVA approach, claims to make as many as 168 adjustments to operating income to arrive at the true return on capital.

While EVA is usually calculated using total capital, it can be easily modified to be an equity measure:

Equity EVA = (Return on Equity - Cost of Equity) (Equity Invested in Project or Firm) Again, a firm that earns a positive equity EVA is creating value for its stockholders while a firm with a negative equity EVA is destroying value for its stockholders.

The measures of excess returns that we computed in the tables in the last illustration can be easily modified to become measures of EVA:

	ROC - Cost	BV of		ROE - Cost		Equity
Company	of Capital	Capital	EVA	of Equity	BV of Equity	EVA
Disney	-4.12%	38009	-1565	-4.70%	23879	-1122
Aracruz	-2.66%	9248	-246	-4.09%	6385	-261
Bookscape	14.53%	4500	654	15.40%	4500	693
Deutsche						
Bank	NMF	NMF	NMF	-4.21%	29991	-1262

Note that EVA converts the percentage excess returns in these tables to absolute excess returns, but it is affected by the same issues of earnings and book value measurement.

# 5.8. 📭 : Stock Buybacks, Return on Capital and EVA

When companies buy back stock, they are allowed to reduce the book value of their equity by the market value of the stocks bought back. When the market value of equity is well in excess of book value of equity, buying back stock will generally

- *a.* increase the return on capital but not affect the EVA
- b. increase the return on capital and increase the EVA
- c. not affect the return on capital but increase the EVA
- d. none of the above

Why or why not?

There is a dataset on the web that summarizes, by sector, the economic value added and the equity economic value added in each.

## **Cash Flow Based Decision Rules**

#### Payback

The payback on a project is a measure of how quickly the cash flows generated by the project cover the initial investment. Consider a project that has the following cash flows:

Cash Flow		\$ 300	\$ 400	\$ 500	\$ 600
	1		1	1	
	1	1			1
Investment	\$ 1000				

The payback on this project is between 2 and 3 years and can be approximated, based upon the cash flows to be 2.6 years.<sup>10</sup>

As with the other measures, the payback can be estimated either for all investors in the project or just for the equity investors. To estimate the payback for the entire firm, the free cash flows *Payback:* The payback for a project is the length of time it will take for nominal cash flows from the project to cover the initial investment.

to the firm are cumulated until they cover the total initial investment. To estimate payback just for the equity investors, the free cash flows to equity are cumulated until they cover the initial equity investment in the project.

## Illustration 5.10: Estimating Payback for the Bookscape Online Service

The following example estimates the payback from the viewpoint of the firm, using the Bookscape On-line Service cash flows estimated in illustration 5.4. Table 5.12 summarizes the annual cashflows and the cumulated value of the cashflows.

Year	Cashflow in year	Cumulated Cashflow
0	-1150000	
1	340000	-810000
2	415000	-395000
3	446500	51500

Table 5.12: Payback for Bookscape Online

4 720730	772230
----------	--------

The initial investment of \$1.15 million is made sometime in the third year, leading to a payback of between two and three years. If we assume that cashflows occur uniformly over the course of the year:

Payback for Project = 2 + (395000/446500) = 2.88 years

## Using Payback in Decision Making

While it is uncommon for firms to make investment decisions based solely on the payback, surveys suggest that some businesses do in fact use payback as their primary decision mechanism. In those situations where payback is used as the primary criterion for accepting or rejecting projects, a "maximum" acceptable payback period is typically set. Projects that pay back their initial investment sooner than this maximum are accepted, while projects that do not are rejected.

Firms are much more likely to employ payback as a secondary investment decision rule and use it either as a constraint in decision making (e.g.: Accept projects that earn a return on capital of at least 15%, as long as the payback is less than 10 years) or to choose between projects that score equally well on the primary decision rule (e.g.: when two mutually exclusive projects have similar returns on equity, choose the one with the lower payback.)

## Biases, Limitations, and Caveats

The payback rule is a simple and intuitively appealing decision rule, but it does not use a significant proportion of the information that is available on a project.

• By restricting itself to answering the question "When will this project make its initial investment?" it ignores what happens after the initial investment is recouped. This is a significant shortcoming when deciding between mutually exclusive projects. To provide a sense of the absurdities this can lead to, assume that you are picking between two mutually exclusive projects with the cash flows shown in Figure 5.2:



On the basis of the payback alone, project B is preferable to project A, since it has a shorter payback period. Most decision makers would pick project A as the better project, however, because of the high cash flows that result after the initial investment is paid back.

- The payback rule is designed to cover the conventional project that involves a large up-front investment followed by positive operating cash flows. It breaks down, however, when the investment is spread over time or when there is no initial investment.
- The payback rule uses nominal cash flows and counts cash flows in the early years the same as cash flows in the later years. Since money has time value, however, recouping the nominal initial investment does not make the business whole again, since that amount could have been invested elsewhere and earned a significant return.

# **Discounted Cash Flow Measures**

Investment decision rules based on discounted cash flows not only replace accounting income with cash flows, but explicitly factor in the time value of money. The two most widely used discounted cash flows rules are <u>net present value</u> and the <u>internal</u> <u>rate of return</u>.

## Net Present Value (NPV)

The <u>net present value</u> of a project is the sum of the present values of each of the cash flows — positive as well as negative — that occurs over the life of the project. The general formulation of the NPV rule is as follows

NPV of Project = 
$$\sum_{t=1}^{t=N} \frac{CF_t}{(1+r)^t}$$
 - Initial Investment

where

 $CF_t$  = Cash flow in period t

r = Discount rate

N = Life of the project

Thus, the net present value of a project with the cash flows depicted in Figure 5.3 and a discount rate of 12% can be written as: *Net Present Value (NPV):* The net present value of a project is the sum of the present values of the expected cash flows on the project, net of the initial investment.



Once the net present value is computed, the decision rule is extremely simple since the hurdle rate is already factored in the present value.

Decision Rule for NPV for Independent Projects

If the NPV $> 0$	->	Accept the project
If the NPV $< 0$	->	Reject the project

Note that a net present value that is greater than zero implies that the project makes a return greater than the hurdle rate. The following examples illustrate the two approaches.

This spreadsheet allows you to estimate the NPV from cash flows to the firm on a project

## 5.9. <sup>137</sup>: The Significance of a positive Net Present Value

Assume that you have analyzed a \$100 million project, using a cost of capital of 15%, and come up with a net present value of \$1 million. The manager who has to decide on the project argues that this is too small of a NPV for a project of this size, and that this indicates a "poor" project. Is this true?

a. Yes. The NPV is only 1% of the initial investment

b. No. A positive NPV indicates a good project

Explain your answer.

# Illustration 5.11: NPV From The Firm's Standpoint - Bookscape On-line

Table 5.13 calculates the present value of the cash flows to Bookscape, as a firm, from the proposed on-line book ordering service, using the cost of capital of 22.76% as the discount rate on the cash flows. (The cash flows are estimated in illustration 5.4 and the cost of capital is estimated in illustration 5.2)

Year	Annual Cashflow	PV of Cashflow	
0	(\$1,150,000)	\$	(1,150,000)
1	\$ 340,000	\$	276,969
2	\$ 415,000	\$	275,392
3	\$ 446,500	\$	241,366
4	\$ 720,730	\$	317,380
NPV		\$	(38,893)

Table 5.13: FCFF on Bookscape On-line

This project has a net present value of -\$38,893, suggesting that it is a project that should not be accepted, based on the projected cash flows and the cost of capital of 22.76%.

Illustration 5.12: NPV From The Firm's Standpoint - Disney's Theme Park in Bangkok

In estimating the cash flows to discount for Disney's theme park in Thailand, the first point to note when computing the net present value of the proposed theme park in Thailand is the fact that it has a life far longer than the ten years shown in exhibit 5.2. To bring in the cash flows that occur after year 10, when cash flows start growing at 2%, the inflation rate forever, we draw on a present value formula for a growing perpetuity (See appendix 1):

Present Value of Cash Flows after year 10 =  $FCFF_{11}/(WACC - g)$ = \$ 663 million/(.1066-.02) = \$7,810 million

The cost of capital of 10.66% is the cost of capital for Bangkok theme park that we estimated in illustration 5.2. This present value is called the *terminal value* and occurs at the end of year 10.

Table 5.14 presents the net present value of the proposed theme parks in Thailand are estimated using the cash flows in nominal dollars, from exhibit 5.2, and Disney's cost of capital, in dollar terms, of 10.66%.

Year	Annual Cashflow	Terminal Value	Present Value
0	-\$2,000		-\$2,000
1	-\$1,000		-\$904
2	-\$880		-\$719
3	-\$289		-\$213
4	\$324		\$216
5	\$443		\$267
6	\$486		\$265
7	\$517		\$254
8	\$571		\$254
9	\$631		\$254
10	\$663	\$7,810	\$3,076
			\$749

Table 5.14: Net Present Value of Disney Bangkok Theme Park

The net present value of this project is positive. This suggests that it is a good project that will earn surplus value for Disney.

When analyzing a project, the cashflows and discount rates can often be estimated in one of several currencies. For a project like the Disney theme park, the obvious choices are the project's local currency (Thai Baht) and the company's domicile currency (U.S. dollars) but we can in fact use any currency to evaluate the project. When switching from one currency to another, we have to go through the following steps:

Estimate the expected exchange rate for each period of the analysis: For some currencies (Euro, Yen or British pound), we can estimates of expected exchange rates from the financial markets in the form of forward rates. For other currencies, we weill have to estimate the exchange rate and the safest way to do so is to use the expected inflation rates in the two currencies in question. For instance, we can estimate the expected Baht/\$ exchange rate in n years:

Expected Rate (Bt/\$) = Bt/\$ (Today) \* 
$$\left[\frac{(1 + \text{Expected Inflation}_{\text{Thailand}})}{(1 + \text{Expected Inflation}_{\text{US}})}\right]^n$$

We are assuming that purchasing power ultimately drives exchange rates – this is called purchasing power parity.

- Convert the expected cashflows from one currency to another in future periods, using these exchange rates: Multiplying the expected cashflows in one currency to another will accomplish this.
- 3. Convert the discount rate from one currency to another: We cannot discount cashflows in one currency using discount rates estimated in another. To convert a discount rate from one currency to another, we will again use expected inflation rates in the two currencies. A dollar cost of capital can be converted into a Thai Baht cost of capital as follows:

Cost of Capital(Bt) = 
$$(1 + \text{Cost of Capital}(\$)) * \frac{(1 + \text{Exp Inflation}_{\text{Thailand}})}{(1 + \text{Exp Inflation}_{\text{US}})} - 1$$

a. Compute the net present value by discounting the converted cashflows (from step 2) at the converted discount rate (from step 3): The net present value should be identical in both currencies but only because the expected inflation rate was used to estimate the exchange rates. If the forecasted exchange rates diverge from

purchasing power parity, we can get different net present values but our currency views are then contaminating our project analysis.

## Illustration 5.13: NPV In Thai Baht - Disney's Theme Park in Bangkok

In illustration 5.12, we computed the net present value for the Disney Theme park in dollar terms to be \$2,317 million. The entire analysis could have been done in Thai Baht terms. To do this, the cash flows would have to be converted from dollars to Thai Baht and the discount rate would then have been a Thai Baht discount rate. To estimate the expected exchange rate, we will assume that the expected inflation rate to be 10% in Thailand and 2% in the United States and the current exchange rate is 42.09 Bt per dollar, the projected exchange rate in one year will be:

Expected Exchange Rate in year 1 = 42.09 Bt \* (1.10/1.02) = 45.39 Bt/\$ Similar analysis will yield exchange rates for each of the next 10 years.

The dollar cost of capital of 10.35%, estimated in illustration 5.1, is converted to a Baht cost of capital using the expected inflation rates:

Cost of Capital (Bt) =  $(1 + \text{Cost of Capital (\$)}) * \frac{(1 + \text{Exp Inflation}_{\text{Thailand}})}{(1 + \text{Exp Inflation}_{\text{US}})} - 1$ = (1.1066) (1.10/1.02) - 1 = 19.34%

Table 5.15 summarizes exchange rates, cash flows and the present value for the proposed Disney theme parks, with the analysis done entirely in Thai Baht.

Year	Cashflow (\$)	<i>Bt/\$</i>	Cashflow (Bt)	Present Value
0	-2000	42.09	-84180	-84180
1	-1000	45.39	-45391	-38034
2	-880	48.95	-43075	-30243
3	-289	52.79	-15262	-8979
4	324	56.93	18420	9080
5	443	61.40	27172	11223
6	486	66.21	32187	11140
7	517	71.40	36920	10707
8	571	77.01	43979	10687
9	631	83.04	52412	10671
10	8474	89.56	758886	129470
١	31,542			

Table 5.15: Expected Cashflows from Disney Theme Park in Thai Bt

Note that the net present value of 31,542 million Bt is exactly equal to the dollar net present value computed in illustration 5.12, converted at the current exchange rate of 42.09 Bt per dollar.

NPV in dollars = NPV in Bt/ Current exchange rate = 31,542/42.09 = \$749 million

# Terminal Value, Salvage Value and Net Present Value

When estimating cashflows for an individual project, practicality constrains us to estimate cashflows for a finite period -3,5 or 10 years, for instance. At the end of that finite period, we can make one of three assumptions.

- The most conservative one is that the project ceases to exist and that its assets are worthless. In that case, the final year of operation will reflect only the operating cashflows from that year.
- We can assume that the project will end at the end of the analysis period and that the assets will be sold for salvage. While we can try to estimate salvage value directly, a common assumption that is made is that salvage value is equal to the book value of the assets. For fixed assets, this will be the undepreciated portion of the initial investment whereas for working capital, it will be the aggregate value of the investments made in working capital over the course of the project life.
- We can also assume that the project will not end at the end of the analysis period and try to estimate the value of the project on an ongoing basis this is the terminal value. In the Disney theme park analysis, for instance, we assumed that the cashflows will continue forever and grow at the inflation rate each year. If that seems too optimistic, we can assume that the cashflows will continue wth no growth or even that they will drop by a constant rate each year.

The right approach to use will depend upon the project being analyzed. For projects that are not expected to last for long periods, we can use either of the first two approaches; a zero salvage value should be used if the project assets are likely to become obsolete by the end of the project life (example: computer hardware) and salvage can be set to book value if the assets are likely to retain significant value (example: buildings).

For projects with long lives, the terminal value approach is likely to yield more reasonable results but with one caveat. The investment and maintenance assumptions made in the analysis should reflect its long life. In particular, capital maintenance expenditures will be much higher for projects with terminal value since the assets have to retain their earning power. In the Disney theme park, the capital maintenance expenditures climb over time and become larger than depreciation as we approach the terminal year.

# 5.10. See: Currency Choices and NPV

A company in a high inflation economy has asked for your advice regarding which currency to use for investment analysis. The company believes that using the local currency to estimate the NPV will yield too low a value, because domestic interest rates are very high - this, in turn, would push up the discount rate. Is this true?

*a.* Yes. A higher discount rate will lead to lower NPV

*b*. No.

Explain your answer.

# NPV: Firm versus Equity Analysis

In the analysis above, the cashflows that we discounted were prior to interest and principal payments and the discount rate we used was the weighted average cost of capital. In NPV parlance, we were discounting cashflows to the entire firm (rather than just its equity investors) at a discount rate that reflected the costs to different claimholders in the firm to arrive at a net present value. There is an alternative. We could have discounted the cashflows left over after debt payments for equity investors at the cost of equity and arrived at a net present value to equity investors.

Will the two approaches yield the same net present value? As a general rule, they will but only if the following assumptions hold:

• The debt is correctly priced and the market interest rate to compute the cost of capital is the right one, given the default risk of the firm. If not, it is possible that equity investors can gain (if interest rates are set too low) or lose (if interest rates are set too high) to bondholders. This, in turn, can result in the net present value to equity being different from the net present value to the firm.

• The same assumptions are made about the financing mix used in both calculations. Note that the financing mix assumption affects the discount rate (cost of capital) in the firm approach and the cashflows (through the interest and principal payments) in the equity approach.

Given that the two approaches yield the same net present value, which one should we choose to use? Many practitioners prefer discounting cashflows to the firm at the cost of capital, because it is easier to do, since the cashflows are before debt payments and we do not therefore have to estimate interest and principal payments explicitly. Cashflows to equity are more intuitive, though, since most of us think of cashflows left over after interest and principal payments as residual cashflows.

## Illustration 5.14: NPV from the Equity Investors' Standpoint- Paper Plant for Aracruz

The net present value is computed from the equity investors' standpoint for the proposed linerboard plant, for Aracruz, using real cash flows to equity, estimated in exhibit 5.4 and a real cost of equity of 11.40 %. Table 5.16 summarizes the cashflows and the present values.

Year	FCFE	PV of FCFE
0	(185,100 BR)	(185,100 BR)
1	34,375 BR	30,840 BR
2	37,201 BR	29,943 BR
3	40,945 BR	29,568 BR
4	45,971 BR	29,784 BR
5	(5,411 BR)	(3,145 BR)
6	46,842 BR	24,427 BR
7	46,661 BR	21,830 BR
8	46,470 BR	19,505 BR
9	46,270 BR	17,424 BR
10	163,809 BR	55,342 BR
NPV		70,418 BR

Table 5.16: FCFE on Linerboard Plant (in '000s)

The net present value of 70.418 million BR suggests that this is a good project for Aracruz to take on.

The analysis was done entirely in real terms, but using nominal cashflows and discount rate would have had no impact on the net present value. The cashflows will be higher because of expected inflation but the discount rate will increase by exactly the

same magnitude, thus resulting in an identical net present value. The choice between nominal and real cash flows therefore boils down to one of convenience. When inflation rates are low, it is better to do the analysis in nominal terms since taxes are based upon nominal income. When inflation rates are high and volatile, it is easier to do the analysis in real terms or in a different currency with a lower expected inflation rate.

# 5.11. 🖙: Equity, Debt and Net Present Value

In the project described above, assume that Aracruz had used all equity to finance the project, instead of its mix of debt and equity. Which of the following is likely to occur to the NPV?

- *a*. The NPV will go up, because the cash flows to equity will be much higher; there will be no interest and principal payments to make each year.
- b. The NPV will go down, because the initial investment in the project will much higher
- *c*. The NPV will remain unchanged, because the financing mix should not affect the NPV
- d. The NPV might go up or down, depending upon .....

Explain your answer.

# Properties of the NPV Rule

The net present value has several important properties that make it an attractive decision rule.

1. Net present values are additive

The net present values of individual projects can be aggregated

*Assets in Place:* These are the assets already owned by a firm, or projects that it has already taken.

to arrive at a cumulative net present value for a business or a division. No other investment decision rule has this property. The property itself raises a number of implications.

• The value of a firm can be written in terms of the net present values of the projects it has already taken on as well as the net present values of prospective future projects

Value of a Firm =  $\sum$  Present Value of Projects in Place +  $\sum$  NPV of expected future projects The first term in this equation captures the value of <u>assets in place</u>, while the second

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term measures the value of *expected future growth*. Note that the present value of projects in place is based on anticipated future cash flows on these projects.

- When a firm terminates an existing project that has a negative present value based on anticipated future cash flows, the value of the firm will increase by that amount. Similarly, when a firm takes on a new project, with a negative net present value, the value of the firm will decrease by that amount.
- When a firm divests itself of an existing asset, the price received for that asset will affect the value of the firm. If the price received exceeds the present value of the anticipated cash flows on that project to the firm, the value of the firm will increase with the divestiture; otherwise, it will decrease.
- When a firm invests in a new project with a positive net present value, the value of the firm will be affected depending upon whether the NPV meets expectations. For example, a firm like Microsoft is expected to take on high positive NPV projects and this expectation is built into value. Even if the new projects taken on by Microsoft have positive NPV, there may be a drop in value if the NPV does not meet the high expectations of financial markets.
- When a firm makes an acquisition, and pays a price that exceeds the present value of the expected cash flows from the firm being acquired, it is the equivalent of taking on a negative net present value project and will lead to a drop in value.

# 2. Intermediate Cash Flows are invested at the hurdle rate

Implicit in all present value calculations are assumptions about the rate at which

intermediate cash flows get reinvested. The net present value rule assumes that intermediate cash flows on a projects —, i.e., cash flows that occur between the initiation and the end of the project

Hurdle Rate:	This	is the		minimum			
acceptable rate	of retu	ırn	that a	firm	will		
accept for taking a given project.							

— get reinvested at the <u>hurdle rate</u>, which is the cost of capital if the cash flows are to the firm and the cost of equity if the cash flows are to equity investors. Given that both the cost of equity and capital are based upon the returns that can be made on alternative investments of equivalent risk, this assumption should be a reasonable one.

## 3. NPV Calculations allow for expected term structure and interest rate shifts

In all the examples throughout in this chapter, we have assumed that the discount rate remains unchanged over time. This is not always the case, however; the net present value can be computed using time-varying discount rates. The general formulation for the NPV rule is as follows

NPV of Project = 
$$\sum_{t=1}^{t=N} \frac{CF_t}{\prod_{j=1}^{j=t} (1 + r_t)}$$
 - Initial Investment

where

 $CF_t$  = Cash flow in period t

 $r_t$  = One-period Discount rate that applies to period t

N = Life of the project

The discount rates may change for three reasons:

- The level of interest rates may change over time and the term structure may provide some insight on expected rates in the future.
- The risk characteristics of the project may be expected to change in a predictable way over time, resulting in changes in the discount rate.
- The financing mix on the project may change over time, resulting in changes in both the cost of equity and the cost of capital.

## Illustration 5.15: NPV Calculation With Time-Varying Discount Rates

Assume that you are analyzing a 4-year project, investing in computer software development. Further, assume that the technological uncertainty associated with the software industry leads to higher discount rates in future years.



The present value of each of the cash flows can be computed as follows -

PV of Cash Flow in year 1 = \$300 / 1.10 = \$272.72

PV of Cash Flow in year 2 = \$400/(1.10 \* 1.11)= \$327.60PV of Cash Flow in year 3 = \$500/(1.10 \* 1.11 \* 1.12)= \$365.63PV of Cash Flow in year 4 = \$600/(1.10 \* 1.11 \* 1.12 \* 1.13)= \$388.27NPV of Project = \$272.72+\$327.60+\$365.63+\$388.27-\$1000.00 = \$354.23

# 5.12. See Changing Discount Rates and NPV

In the above analysis, assume that you had been asked to use one discount rate for all of the cash flows. Is there a discount rate that would yield the same NPV as the one above? *a.* Yes

b. No

If yes, how would you interpret this discount rate?

#### Biases, Limitations, and Caveats

In spite of its advantages and its linkage to the objective of value maximization, the net present value rule continues to have its detractors, who point out several limitations

- The net present value is stated in absolute rather than relative terms and does not, therefore, factor in the scale of the projects. Thus, project A may have a net present value of \$200, while project B has a net present value of \$100, but project A may require an initial investment that is ten or 100 times larger than project B. Proponents of the NPV rule argue that it is surplus value, over and above the hurdle rate, no matter what the investment.
- The net present value rule does not control for the life of the project. Consequently, when comparing mutually exclusive projects with different lifetimes, the NPV rule is biased towards accepting longer term projects.

# Internal Rate of Return

The internal rate of return is based on discounted cash flows. Unlike the net present value rule, however, it takes into account the project's scale. It is the discounted

cash flow analog to the accounting rates of return. Again, in general terms, the internal rate of return is that discount rate that makes the net

*Internal Rate of Return (IRR):* The IRR of a project measures the rate of return earned by the project based upon cash flows, allowing for the time value of money. present value of a project equal to zero. To illustrate, consider again the project described at the beginning of the net present value discussion.



At the internal rate of return, the net present value of this project is zero. The linkage between the net present value and the internal rate of return is most visible when the net present value is graphed as a function of the discount rate in a <u>net present value profile</u>. A net present value profile for the project described is illustrated in Figure 5.4.



#### Figure 5.4: NPV Profile

Discount Rate

The net present value profile provides several insights on the project's viability. First, the internal rate of return is clear from the graph – it is the point at which the profile crosses the X axis. Second, it provides a measure of how sensitive the NPV — and, by extension, the project decision — is to changes in the

*NPV Profile:* This measures the sensitivity of the net present value to changes in the discount rate.

discount rate. The slope of the NPV profile is a measure of the discount rate sensitivity of the project. Third, when mutually exclusive projects are being analyzed, graphing both NPV profiles together provides a measure of the break-even discount rate - the rate at which the decision maker will be indifferent between the two projects.

# 5.13. <sup>ISP</sup>: Discount Rates and NPV

In the project described above, the NPV decreased as the discount rate was increased. Is this always the case?

a. Yes.

b. No

If no, when might the NPV go up as the discount rate is increased?

# Using the Internal Rate of Return

One advantage of the internal rate of return is that it can be used even in cases where the discount rate is unknown. While this is true for the calculation of the IRR, it is <u>not true</u> when the decision maker has to use the IRR to decide whether to take a project or not. At that stage in the process, the internal rate of return has to be compared to the discount rate - if the IRR is greater than the discount rate, the project is a good one; alternatively, the project should be rejected.

Like the net present value, the internal rate of return can be computed in one of two ways:

- The IRR can be calculated based upon the free cash flows to the firm and the total investment in the project. In doing so, the IRR has to be compared to the cost of capital.
- The IRR can be calculated based upon the free cash flows to equity and the equity investment in the project. If it is estimated with these cash flows, it has to be compared to the cost of equity, which should reflect the riskiness of the project.

Decision Rule for IRR for Independent Projects				
A. IRR is computed on cash flows to the firm				
If the	e IRR > Cost of Capital	->	Accept the project	
If th	e IRR < Cost of Capital	->	Reject the project	

B. IRR is computed on cash flows to equity					
If the IRR > Cost of Equity	->	Accept the project			
If the IRR < Cost of Equity	->	Reject the project			

When choosing between projects of equivalent risk, the project with the higher IRR is viewed as the better project.

This spreadsheet allows you to estimate the IRR based upon cash flows to the firm on a project

Illustration 5.16: Estimating the IRR based on FCFF - Disney Theme Park in Thailand

The cash flows to the firm from the proposed theme park in Thailand, are used to arrive at a NPV profile for the project in Figure 5.5.





The internal rate of return in dollar terms on this project is 11.97%, which is <u>higher</u> than the cost of capital of 10.66%. These results are consistent with the findings from the NPV rule, which also recommended investing in the theme parks. <sup>11</sup>

## Illustration 5.17: Estimating IRR Based Upon FCFE - Aracruz Cellulose

The net present value profile depicted in Figure 5.6 is based upon the equity investment and the free cash flows to equity estimated for the paper plant for Aracruz.





The internal rate of return (in real terms) on this project is 18.06%, which is <u>higher</u> than the real cost of equity of 11.40%. Again, these results are consistent with the findings from the NPV rule, which also recommended accepting this investment.

## Biases, Limitations, and Caveats

The internal rate of return is the most widely used discounted cash flow rule in investment analysis, but it does have some serious limitations.

<sup>&</sup>lt;sup>11</sup> The terminal value of the project itself is a function of the discount rate used. That is why the IRR function in excel will not yield the right answer. Instead, the net present value has to be recomputed at every discount rate and the IRR is the point at which the NPV=0.

- Since the IRR is a scaled measure, it tends to bias decision makers towards smaller projects, which are much more likely to yield high percentage returns, over larger ones.
- There are a number of scenarios where the internal rate of return cannot be computed or is not meaningful as a decision tool. The first is when there is no or only a very small initial investment and the investment is spread over time. In such cases, the IRR cannot be computed, or, if computed, is likely to be meaningless. The second is when there is more than one internal rate of return for a project, and it is not clear which one the decision maker should use.

# Illustration 5.18: Multiple IRR Projects

Consider a project to manufacture and sell a consumer product, with a hurdle rate of 12%, that has a 4-year life and the following cash flows over those 4 years. The project, which requires the licensing of a trademark, requires a large negative payment at the end of the fourth year. Figure 5.7 shows the cashflows:

Figure 5.7: Cashflows on Investment



The net present value profile for this project, shown in figure 5.8, reflects the problems that arise with the IRR measure.



As you can see, this project has two internal rates of return - 6.60% and 36.55%. Since the hurdle rate falls between these two IRRs, the decision on whether to take the project or not will change depending upon which IRR is used. In order to make the right decision in this case, the decision maker would have to look at the NPV profile. If, as in this case, the net present value is positive at the hurdle rate, the project should be accepted. If the net present value is negative at the hurdle rate, the project should be rejected.

## Multiple IRRs: Why They Exist And What To Do About Them.

The internal rate of return can be viewed mathematically as a root to the present value equation for cash flows. In the conventional project, where there is an initial investment and positive cash flows thereafter, there is only one sign change in the cash flows, and one root - that is, there is a unique IRR. When there is more than one sign change in the cash flows, there will be more than one internal rate of return.<sup>12</sup> In Figure

<sup>&</sup>lt;sup>12</sup> While the number of internal rates of return will be equal to the number of sign changes, some internal rates of return may be so far out of the realm of the ordinary (eg. 10,000%) that they may not create the kinds of problems described here.

5.6, for example, the cash flow changes sign from negative to positive in year 1, and from positive to negative in year 4, leading to internal rates of return.

Lest this be viewed as some strange artifact that is unlikely to happen in the real world, note that many long term projects require substantial reinvestment at intermediate points in the project and that these reinvestments may cause the cash flows in those years to become negative. When this happens, the IRR approach may run into trouble.

There are a number of solutions suggested to the multiple IRR problems. One is to use the hurdle rate to bring the negative cash flows from intermediate periods back to the present. Another is to construct a NPV profile. In either case, it is probably much simpler to estimate and use the net present value.

#### Comparing NPV and IRR

While the net present value and the internal rate of return are viewed as competing investment decision rules, they generally yield similar conclusions in most cases. The differences between the two rules are most visible when decision makers are choosing between mutually exclusive projects.

## Differences in Scale

The net present value of a project is stated in dollar terms and does not factor in the scale of the project. The internal rate of return, by contrast, is a percentage rate of return, which is standardized for the scale of the project. When choosing between mutually exclusive projects with very different scales, this can lead to very different results.

## Illustration 5.19: NPV and IRR for projects of different scale

Assume that you are a small bank and that you are comparing two mutually exclusive projects. The first project, which is hire 4 extra tellers at the branches that you operate, requires an initial investment of \$1 million and produces the cash flow revenues shown below in Figure 5.7. The second project requires investment of \$10 million in an Automated Teller Machine, and is likely to produce the much higher cash flows shown in Figure 5.9, as well. The hurdle rate is 15% for both projects.

# Figure 5.9: NPV and IRR - Different Scale Projects



results. The net present value rule suggests that project B is the better project, while the internal rate of return rule leans towards project A. This is not surprising, given the differences in scale.

Capital Rationing:	This	refers	to	the
scenario where the firm	does n	ot have	suffic	eient
funds - either on hand o	or in te	erms of	acces	s to
markets - to take on all	of the	good	projec	ts it
might have.				

Which rule yields the better decision? The answer depends on the capital rationing constraints faced by the business

making the decision. When there are no capital rationing constraints (i.e., the firm has the capacity to raise as much capital as it needs to take prospective projects), the

Profitability Index (PI):				The	prof	itabi	ility
index is	the	net	present	value	of a	pro	ject
divided	by	the	initial	investı	nent	in	the
project – it is a scaled version of NPV.							

net present value rule provides the right answer - Project B should be picked over Project A. If there are capital rationing constraints, however, then taking Project B may lead to the rejection of good projects later on. In those cases, the internal rate of return rule may

provide the better solution. The capital rationing question is dealt with in more detail in Chapter 6.

## Another approach to scaling NPV: The Profitability Index

Another way of scaling the net present value is to divide it by the initial investment in the project. Doing so provides the profitability index which is another measure of project return.

 $Profitability Index = \frac{Net Present Value}{Initial Investment}$ 

In Illustration 5.17, for instance, the profitability index can be computed as follows for each project:

Profitability Index for Project A = 467,937/, 1,000,000 = 46.79%

Profitability Index for Project B = \$ 1,358,664/ \$10,000,000 = 13.59%

Based on the profitability index, project A is the better project, after scaling for size.

In most cases, the profitability index and the internal rate of return will yield similar results. As we will see in the next section, the differences between these approaches can be traced to differences in reinvestment assumptions.

# Differences in Reinvestment Rate Assumption

While the differences between the NPV rule and the IRR rules due to scale are fairly obvious, there is a subtler, and much more significant difference between the two rules, relating to the reinvestment of intermediate cash flows. As pointed out earlier, the net present value rule assumes that intermediate cash flows are reinvested at the discount rate, whereas the IRR rule assumes that intermediate cash flows are reinvested at the IRR. As a consequence, the two rules can yield different conclusions, even for projects with the same scale, as illustrated in Figure 5.10.



In this case, the net present value rule ranks the second investment higher, while the IRR rule ranks first investment as the better project. The differences arise because the NPV rule assumes that intermediate cash flows get invested at the hurdle rate, which is 15%. The IRR rule assumes that intermediate cash flows get reinvested at the IRR of that project. While both projects are impacted by this assumption, it has a much greater effect for project A, which has higher cash flows earlier on. The reinvestment assumption is made clearer if the expected end balance is estimated under each rule.

End Balance for ATM1 with IRR of  $21.41\% = $10,000,000*1.2141^4 = $21,730,887$ 

End Balance for ATM2 with IRR of  $20.88\% = $10,000,000*1.2088^4 = $21,353,673$ 

To arrive at these end balances, however, the cash flows in years 1, 2, and 3 will have to be reinvested at the IRR. If they are reinvested at a lower rate, the end balance on these projects will be lower than the values stated above, and the actual return earned will be

lower than the IRR even though the cash flows on the project came in as anticipated.

The reinvestment rate assumption made by the IRR rule creates more serious *Modified Internal Rate of Return (MIRR):* This is the internal rate of return, computed on the assumption that intermediate cashflows are reinvested at the hurdle rate.
consequences the longer the term of the project and the higher the IRR, since it implicitly assumes that the firm has and will continue to have, a fountain of projects yielding returns similar to that earned by the project under consideration.

A Solution to the Reinvestment Rate Problem: The Modified Internal Rate of Return

One solution that has been suggested for the reinvestment rate assumption is to assume that intermediate cash flows get reinvested at the hurdle rate - the cost of equity if the cash flows are to equity investors and the cost of capital if they are to the firm - and to calculate the internal rate of return from the initial investment and the terminal value. This approach yields what is called the modified internal rate of return (MIRR), as illustrated in Figure 5.11.



Figure 5.11: IRR versus Modified Internal Rate of Return

Modified Internal Rate of Return =  $(\$2160/\$1000)^{1/4} - 1 = 21.23\%$ 

The modified internal rate of return is lower than the internal rate of return because the intermediate cash flows are invested at the hurdle rate of 15% instead of the IRR of 24.89%.

There are many who believe that the MIRR is neither fish nor fowl, since it is a mix of the NPV rule and the IRR rule. From a practical standpoint, the MIRR becomes a weighted average of the returns on individual projects and the hurdle rates the firm uses, with the weights on each depending on the magnitude and timing of the cash flows - the

larger and earlier the cash flows on the project, the greater the weight attached to the hurdle rate. Furthermore, the MIRR approach will yield the same choices as the NPV approach for projects of the same scale and lives.

# Where Do Good Projects Come From?

In the process of analyzing new investments in the preceding chapters, we have contended that good projects have a positive net present value and earn an internal rate of return greater than the hurdle rate. While these criteria are certainly valid from a measurement standpoint, they do not address the deeper questions about good projects including the economic conditions that make for a "good" project and why it is that some firms have a more ready supply of "good" projects than others.

Implicit in the definition of a good project — one that earns a return that is greater than that earned on investments of equivalent risk — is the existence of super-normal returns to the business considering the project. In a competitive market for real investments, the existence of these excess returns should act as a magnet, attracting competitors to take on similar investments. In the process, the excess returns should dissipate over time; how quickly they dissipate will depend on the ease with which competition can enter the market and provide close substitutes and on the magnitude of any differential advantages that the business with the good projects might possess. Take an extreme scenario, whereby the business with the good projects has no differential advantage in cost or product quality over its competitors, and new competitors can enter the market easily and at low cost to provide substitutes. In this case the super-normal returns on these projects should disappear very quickly.

An integral basis for the existence of a "good" project is the creation and maintenance of barriers to new or existing competitors taking on equivalent or similar projects. These barriers can take different forms, including

*a. Economies of scale*: Some projects might earn high returns only if they are done on a "large" scale, thus restricting competition from smaller companies. In such cases, large companies in this line of business may be able to continue to earn super-normal returns on their projects because smaller competitors will not be able to replicate them.

*b. Cost Advantages*: A business might work at establishing a cost advantage over its competitors, either by being more efficient or by taking advantage of arrangements that its competitors cannot use. For example, in the late 1980s, Southwest Airlines was able to establish a cost advantage over its larger competitors, such as American and United Airlines by using non-union employees, the company exploited this cost advantage to earn much higher returns.

*c. Capital Requirements*: Entry into some businesses might require such large investments that it discourages competitors from entering, even though projects in those businesses may earn above-market returns. For example, assume that Boeing is faced with a large number of high-return projects in the aerospace business. While this scenario would normally attract competitors, the huge initial investment needed to enter this business would enable Boeing to continue to earn these high returns.

*d. Product Differentiation*: Some businesses continue to earn excess returns by differentiating their products from those of their competitors, leading to either higher profit margins or higher sales. This differentiation can be created in a number of ways - through effective advertising and promotion (Coca Cola), technical expertise (Sony), better service (Nordstrom) and responsiveness to customer needs.

*e. Access to Distribution Channels*: Those firms that have much better access to the distribution channels for their products than their competitors are better able to earn excess returns. In some cases, the restricted access to outsiders is due to tradition or loyalty to existing competitors. In other cases, the firm may actually own the distribution channel, and competitors may not be able to develop their own distribution channels because the costs are prohibitive.

*f. Legal and Government Barriers*: In some cases, a firm may be able to exploit investment opportunities without worrying about competition because of restrictions on competitors from product patents the firm may own to government restrictions on competitive entry. These arise, for instance, when companies are allowed to patent products or services, and gain the exclusive right to provide them over the patent life.

#### **Quality of Management and Project Quality**

In the preceding section we examined some of the factors that determine the attractiveness of the projects a firm will face. While some factors, such as government restrictions on entry, may largely be out of the control of incumbent management, there are other factors that can clearly be influenced by management.<sup>13</sup> may largely be out of the control of incumbent management, there are other factors that can clearly be influenced by management.<sup>13</sup> may largely be out of the control of incumbent management, there are other factors that can clearly be influenced by management. Considering each of the factors discussed above, for instance, we would argue that a good management team can increase both the number of and the returns on available projects by

- taking projects that exploit any economies of scale that the firm may possess; in addition, management can look for ways it can create economies of scale in the firm's existing operations.
- <u>establishing and nurturing cost advantages over its competitors</u>; some cost advantages may arise from labor negotiations, while others may result from long-term strategic decisions made by the firm. For instance, by owning and developing SABRE, the airline reservation system, American Airlines has been able to gain a cost advantage over its competitors.
- taking actions that increase the initial cost for new entrants into the business; one of the primary reasons Microsoft's was able to dominate the computer software market in the early 1990s was its ability to increase the investment needed to develop and market software programs.
- increasing brand name recognition and value through advertising and by delivering superior products to customers; a good example is the success that Snapple experienced in the early 1990s in promoting and selling its iced tea beverages.
- <u>nurturing markets in which the company's differential advantage is greatest, in terms</u>
  <u>of either cost of delivery or brand name value</u>. In some cases, this will involve
  expanding into foreign markets, as both Levi Strauss and McDonalds did in the 1980s
  in order to exploit their higher brand name recognition in those markets. In other

<sup>&</sup>lt;sup>13</sup> When government policy is influenced by lobbying by firms, it can be argued that even these factors may be affected by the management of a firm.

cases, this may require concentrating on segments of an existing market as The Gap did, when it opened its Banana Republic division, which sells upscale outdoor clothing.

- <u>improving the firm's reputation for customer service and product delivery</u>; this will enable the firm to increase both profits and returns. One of the primary factors behind Chrysler's financial recovery in the 1980s was the company's ability to establish a reputation for producing quality cars and minivans.
- <u>developing distribution channels that are unique and cannot be easily accessed by</u> <u>competitors</u>. Avon, for instance, emplyed large sales force to go door-to-door to reach consumers who could not be reached by other distribution channels.
- <u>getting patents on products or technologies that keep out the competition and earn</u> <u>high returns;</u> doing so may require large investments in research and development over time. It can be argued that Intel's success in the market for semiconductors can be traced to the strength of its research and development efforts and the patents it consequently obtained on advanced chips, such as the Pentium.<sup>14</sup>

While the quality of management is typically related to the quality of projects a firm possesses, a good management team does not guarantee the existence of good projects. In fact, there is a rather large element of chance involved in the process; even the best laid plans of the management team to create project opportunities may come to naught if circumstances conspire against them – a recession may upend a retailer, or an oil price shock may cause an airline to lose money.

#### The Role of Acquisitions

As firms mature and increase in size, they are often confronted with a quandary. Instead of being cash poor and project rich, they find that their existing projects generate far more in cash than they have available projects in which to invest. This can be attributed partly to size and partly to competition. As they face up to their new status as cash-rich companies, with limited investment opportunities, acquiring other firms with a ready supply of high-return projects looks like an attractive option, but there is a catch. If these firms are publicly traded, the market price already reflects the expected higher

<sup>&</sup>lt;sup>14</sup> It is estimated that Intel spent between \$3 billion and \$5 billion developing the Pentium chip.

returns not only on existing projects but also on expected future projects. In terms of present value, the value of a firm can be written as

Value of Firm = Present Value of Cash Flows from Existing Projects

+ Net Present Value of Cash Flows from Expected Future Projects Thus, firms that are earning super-normal returns on their existing projects and are expected to maintain this status in the future will sell at prices that reflects these expectations. Accordingly, even if the cash-rich firm pays a "fair" price to acquire one of these firms, it has to earn more than the expected super normal returns to be able to claim any premium from the acquisition. To put all this in perspective, assume that you are

considering the acquisition of a firm that is earning 25% on its projects, when the hurdle rate on these projects is 12%, and that it is expected to maintain these high returns for the foreseeable future. A fair price attached to this acquisition will reflect this expectation. All this implies that

Super Normal Returns: These are returns which are greater than the returns that would normally be earned for an investment of equivalent risk.

an acquisition will earn super-normal returns for the acquirer if, and only if, one of the following conditions holds:

- The acquisition is done at a price below the fair price (i.e., the company is significantly undervalued).
- The acquisition is done at a price that reflects the expectation that the firm will earn 25% but the acquirer manages to earn an even higher return, say 30%, on future projects.

Synergy:		This is the increase in the			
value	that	results	from	combining	two
firms.					

- The acquisition enables the firm to take on projects that it would not have taken on as an independent firm; the net present value of these additional projects will then be a bonus that is earned by the acquiring firm. This is the essence of <u>synergy</u>.
- The acquisition lowers the discount rate on projects, leading to an increase in net present value, even though the returns may come in as expected.

Overall, it is clear that internally generated projects have better odds of success than do acquisitions since no premium is paid for market expectations up front.

# 5.14. S: Firm Value and Overpayment on Acquisitions

Megatech Corporation, a large software firm with a market value for its equity of \$ 100 million, announces that it will be acquiring FastMail Corporation, a smaller software firm, for \$ 15 million. On the announcement, Megatech's stock price drops by 3%. Based upon these facts, estimate the amount the market thinks Megatech should have paid for FastMail Corporation.

- a. \$15 million
- *b*. \$ 3 million
- *c*. \$ 12 million

How does NPV additivity enter into your answer?

## **Corporate Strategy and Project Quality**

At the lofty level of corporate strategy, there may be seem to be little use for the mechanics of corporate finance. Consequently, corporate strategic decisions are often made with little or no corporate financial analysis to back them up. One way in which corporate strategy <u>can be</u> linked to corporate finance, however, is through investment policy. An objective of any corporate strategy should be to enable the firm to develop a long-term capacity to differentiate itself and earn higher returns than its competitors. Alternatively, the efficacy of a corporate strategic choice can be measured through its effect on the firm's capacity to earn excess returns on its projects. Many of the concepts that are popular in corporate strategy can be linked to the discussion in the previous section.

## Conclusion

Investment analysis is arguably the most important part of corporate financial analysis. In this chapter, we have defined the scope of investment analysis, and examined a range of investment analysis techniques, ranging from accounting rate of return measures, such as return of equity and return on assets, to discounted cash flow techniques, such as net present value and internal rate of return. In general, it can be argued that:

- Any decision that requires the use of resources is an investment decision; thus, investment decisions cover everything from broad strategic decisions at one extreme to decisions on how much inventory to carry at the other.
- There are two basic approaches to investment analysis; in the equity approach, the returns to equity investors from a project are measured against the cost of equity to decide on whether to take a project; in the firm approach, the returns to all investors in the firm are measured against the cost of capital to arrive at the same judgment.
- Accounting rate of return measures, such as return on equity or return on capital, generally work better for projects that have large initial investments, earnings that are roughly equal to the cash flows, and level earnings over time. For most projects, accounting returns will increase over time, as the book value of the assets is depreciated.
- Payback, which looks at how quickly a project returns its initial investment in nominal cash flow terms, is a useful secondary measure of project performance or a measure of risk, but it is not a very effective primary technique because it does not consider cash flows after the initial investment is recouped.
- Discounted cash flow methods provide the best measures of true returns on projects because they are based upon cashflows and consider the time value of money.
- Among discounted cash flow methods, net present value provides an un-scaled measure while internal rate of return provides a scaled measure of project performance. Both methods require the same information, and, for the most part, they agree when used to analyze independent projects. The internal rate of return does tend to overstate the return on good projects because it assumes that intermediate cash flows get reinvested at the internal rate of return. When analyzing mutually exclusive projects, the internal rate of return is biased towards smaller projects and may be the more appropriate decision rule for firms that have capital constraints.
- Firms seem much more inclined to use internal rate of return than net present value as a investment analysis tool; this can be partly attributed to fact that IRR is a scaled measure of return, and partly to capital rationing constraints firms may face.

# Live Case Study

### **Analyzing A Firm's Existing Investments**

*Objective:* To analyze a firm's existing investments, and to identify differential advantages that explain excess returns on existing investments.

## Key Questions:

- 1. How good or bad is the firm's existing project portfolio?
- 2. What are the firm's competitive strengths and differential advantages, if any?
- 3. Does this firm earn excess returns on its existing projects? If yes, can it maintain the competitive strengths that allowed it to earn these excess returns? If not, what can it do to start earning excess returns on its projects?
- 4. Does the firm have poor investments? If so, what might be the reasons for the poor returns?

#### Framework for Analysis:

1. Analyzing Existing Investments

1.1. What is the accounting return that the firm earns on its existing investments? How does this compare with the cost of equity and capital?

1.2. What was the firm's economic value added in the most recent financial year? How does it compare with the previous year?

1.3. What, if anything, do the accounting returns and economic value added tell you about the quality of the firm's existing investments?

2. Assessing Competitive Strengths

2.1. Who are the primary competitors to this firm and how does the firm compare to them in terms of both quantitative (size, profitability, risk) and qualitative measures (quality of management, service)?

2.2. Does the firm have any special strength that no other firm in the sector possesses?

2.3. Does the firm lag other firms in the sector on any of the measures?

3. Evaluating Sustainability of Competitive Strengths

3.1. Are the firm's competitors catching up with the firm on its strengths?

3.2. Are there new competitors either in the market or on the horizon who could compete with the firm on its strengths?

# 4. Poor Investments

3.1. If the firm has investments that earn less than the hurdle rate, what is the most likely reason for the poor returns?

3.2. What alternatives does the firm have with these poor investments? In particular, can it sell these investments to a third party or will it have to liquidate these investments?

#### Getting Information on Competitive Strengths and Excess Returns

This is primarily a qualitative assessment. Reading articles on the firm and the sector in which it operates is a good starting point. Looking at the differences across firms in the sector on size, margins, working capital ratios and risk can also provide a basis for the competitive analysis. A useful comparison would be between the excess return (return on capital – cost of capital) earned by your firm and the average excess return earned by the sector.

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

#### **Questions and Exercises**

1. You have been given the following information on a project:

- It has a 5-year lifetime
- The initial investment in the project will be \$25 million, and the investment will be depreciated straight line, down to a salvage value of \$10 million at the end of the fifth year.
- The revenues are expected to be \$20 million next year and to grow 10% a year after that for the remaining 4 years.
- The cost of goods sold, excluding depreciation, is expected to be 50% of revenues.
- The tax rate is 40%.
- a. Estimate the pre-tax return on capital, by year and on average, for the project.

b. Estimate the after-tax return on capital, by year and on average, for the project.

c. If the firm faced a cost of capital of 12%, should it take this project.

2. Now assume that the facts in problem 1 remain unchanged except for the depreciation method, which is switched to an accelerated method with the following depreciation schedule:

Year % of Depreciable Asset

1	40%
2	24%
3	14.4%
4	13.3%
5	13.3%

Depreciable Asset = Initial Investment - Salvage Value

a. Estimate the pre-tax return on capital, by year and on average, for the project.

b. Estimate the after-tax return on capital, by year and on average, for the project.

c. If the firm faced a cost of capital of 12%, should it take this project?

3. Consider again the project described in problem 1 (assume that the depreciation reverts to straight line). Assume that 40% of the initial investment for the project will be financed with debt, with an annual interest rate of 10% and a balloon payment of the principal at the end of the fifth year.

a. Estimate the return on equity, by year and on average, for this project.

b. If the cost of equity is 15%, should the firm take this project?

4. Answer true or false to the following statements:

a. The return on equity for a project will always be higher than the return on capital on the same project.

b. If the return on capital is less than the cost of equity, the project should be rejected.

c. Projects with high financial leverage will have higher interest expenses and lower net income than projects with low financial leverage and thus end up with a lower return on equity.

d. Increasing the depreciation on an asset will increase the estimated return on capital and equity on the project.

e. The average return on equity on a project over its lifetime will increase if we switch from straight line to double declining balance depreciation.

5. Under what conditions will the return on equity on a project be equal to the internal rate of return, estimated from cashflows to equity investors, on the same project?

6. You are provided with the projected income statements for a project:

Year	1	2	3	4
Revenues	\$ 10,000	\$ 11,000	\$12,000	\$13,000
- Cost of Goods Sold	\$ 4,000	\$ 4,400	\$ 4,800	\$ 5,200
- Depreciation	\$ 4,000	\$ 3,000	\$ 2,000	\$ 1,000
= EBIT	\$ 2,000	\$ 3,600	\$ 5,200	\$ 6,800

• The tax rate is 40%.

- The project required an initial investment of \$15,000 and an additional investment of \$2,000 at the end of year 2.
- The working capital is anticipated to be 10% of revenues, and the working capital investment has to be made at the beginning of each period.

a. Estimate the free cash flow to the firm for each of the 4 years.

b. Estimate the payback period for investors in the firm.

c. Estimate the net present value to investors in the firm, if the cost of capital is 12%. Would you accept the project?

d. Estimate the internal rate of return to investors in the firm. Would you accept the project?

7. Consider the project described in problem 6. Assume that the firm plans to finance 40% of its net capital expenditure and working capital needs with debt.

a. Estimate the free cash flow to equity for each of the 4 years.

b. Estimate the payback period for equity investors in the firm.

c. Estimate the net present value to equity investors if the cost of equity is 16%. Would you accept the project?

d. Estimate the internal rate of return to equity investors in the firm. Would you accept the project?

8. You are provided with the following cash flows on a project:

Year	Cash Flow to Firm
0	- 10,000,000
1	\$ 4,000,000
2	\$ 5,000,000
3	\$ 6,000,000

Plot the net present value profile for this project. What is the internal rate of return? If this firm had a cost of capital of 10% and a cost of equity of 15%, would you accept this project?

9. You have estimated the following cash flows on a project:

Year	Cashflow to Equity
0	-\$ 5,000,000
1	\$4,000,000
2	\$ 4,000,000
3	- \$3,000,000

Plot the net present value profile for this project. What is the internal rate of return? If the cost of equity is 16%, would you accept this project?

10. Estimate the modified internal rate of return for the project described in problem 8. Does it change your decision on accepting this project?

11. You are analyzing two mutually exclusive projects with the following cash flows:

В	А	Year
-\$4,000,000	-\$4,000,000	0
\$1,000,000	\$2,000,000	1
\$1,500,000	\$1,500,000	2
\$1,700,000	\$ 1,250,000	3
\$2,400,000	\$1,000,000	4

a. Estimate the net present value of each project, assuming a cost of capital of 10%. Which is the better project?

b. Estimate the internal rate of return for each project. Which is the better project?

c. What reinvestment rate assumptions are made by each of these rules? Can you show the effect on future cash flows of these assumptions?

d. What is the modified internal rate of return on each of these projects?

12. You have a project that does not require an initial investment but has its expenses spread over the life of the project. Can the IRR be estimated for this project? Why or why not?

13. Businesses with severe capital rationing constraints should use IRR more than NPV. Do you agree? Explain.

14. You have to pick between three mutually exclusive projects with the following cash flows to the firm:

Year	Project A	Project B	Project C
0	-\$10,000	\$ 5,000	-\$15,000
1	\$ 8,000	\$ 5,000	\$ 10,000
2	\$ 7,000	-\$8,000	\$10,000

The cost of capital is 12%.

a. Which project would you pick using the net present value rule?

b. Which project would you pick using the internal rate of return rule?

c. How would you explain the differences between the two rules? Which one would you rely on to make your choice?

15. You are analyzing an investment decision, in which you will have to make an initial investment of \$10 million and you will be generating annual cash flows to the firm of \$2 million every year, growing at 5% a year, forever.

- a. Estimate the NPV of this project, if the cost of capital is 10%.
- b. Estimate the IRR of this project.

16. You are analyzing a project with a 30-year lifetime, with the following characteristics:

- The project will require an initial investment of \$20 million and additional investments of \$5 million in year 10 and \$5 million in year 20.
- The project will generate earnings before interest and taxes of \$3 million each year. (The tax rate is 40%.)
- The depreciation will amount to \$500,000 each year, and the salvage value of the equipment will be equal to the remaining book value at the end of year 30.
- The cost of capital is 12.5%.

a. Estimate the net present value of this project.

b. Estimate the internal rate of return on this project. What might be some of the problems in estimating the IRR for this project?

17. You are trying to estimate the NPV of a 3-year project, where the discount rate is expected to change over time.

Year	Cash Flow to Firm	Discount Rate
0	-\$15,000	9.5%
1	\$5,000	10.5%
2	\$ 5,000	11.5%
3	\$ 10,000	12.5%

a. Estimate the NPV of this project. Would you take this project?

b. Estimate the IRR of this project. How would you use the IRR to decide whether to take this project or not?

18. Barring the case of multiple internal rates of return, is it possible for the net present value of a project to be positive, while the internal rate of return is less than the discount rate. Explain.

19. You are helping a manufacturing firm decide whether it should invest in a new plant. The initial investment is expected to be \$ 50 million, and the plant is expected to generate after-tax cashflows of \$ 5 million a year for the next 20 years. There will be an additional investment of \$ 20 million needed to upgrade the plant in 10 years. If the discount rate is 10%,

a. Estimate the Net Present Value of the project.

b. Prepare a Net Present Value Profile for this project.

c. Estimate the Internal Rate of Return for this project. Is there any aspect of the cashflows that may prove to be a problem for calculating IRR?

20. You have been asked to analyze a project, where the analyst has estimated the return on capital to be 37% over the ten-year lifetime of the project. While the cost of capital is only 12%, you have concerns about using the return on capital as an investment decision rule. Would it make a difference if you knew that the project was employing an accelerated depreciation method to compute depreciation? Why?

21. Accounting rates of return are based upon accounting income and book value of investment, whereas internal rates of return are based upon cashflows and take into account the time value of money. Under what conditions will the two approaches give you similar estimates?