Capital Budgeting: Cash Flows

The value of a particular asset isn't always easy to determine. However, managers are continually faced with decisions about which assets to invest in. In this chapter, we will look at the different types of investment decisions the financial manager faces. We will also discuss ways to estimate the benefits and costs associated with these decisions.

The financial manager's objective is to maximize owners' wealth. To accomplish this, the manager must evaluate investment opportunities and determine which ones will add value to the firm. For example, consider three firms, Firms A, B and C, each having identical assets and investment opportunities, but that:

- Firm A's management does not take advantage of its investment opportunities and simply pays all of its earnings to its owners;
- Firm B's management only makes those investments necessary to replace deteriorating plant and equipment, paying out any leftover earnings to its owners; and
- Firm C's management invests in all those opportunities that provide a return better than what the owners could have earned if they had invested the funds themselves.

In the case of Firm A, the owners' investment in the firm will not be as profitable as it would be if the firm had taken advantage of better investment opportunities. By failing to invest even to replace deteriorating plant and equipment, Firm A will eventually shrink until it has no more assets. Firm B's management is not taking advantage of all profitable investments. This means that there are forgone opportunities, and owners' wealth is not maximized. But Firm C's management is making all profitable investments and is thus maximizing owners' wealth. Firm

C will continue to grow as long as there are profitable investment opportunities and its management takes advantage of them.

In this chapter, we will describe the process of making investment decisions. We will look at estimating how much a firm's cash flows will change in the future as a result of an investment decision. The main topic of this chapter, estimating cash flow, is an imprecise art at best. Therefore, after we describe in detail a method for estimating cash flows, including two integrative examples, we will explain some ways in which managers sometimes deviate from the ideal method in actual practice.

In the next chapter, Chapter 13, we will analyze the change in the firm's cash flows using techniques that lead the financial manager to a decision regarding whether to invest in a project. In Chapter 14, we see how uncertainty affects the cost of capital and, hence, the investment decision.

THE INVESTMENT PROBLEM

Firms continually invest funds in assets and these assets produce income and cash flows that the firm can then either reinvest in more assets or pay to the owners. These assets represent the firm's capital. ***Capital*** is the firm's total assets. It includes all tangible and intangible assets. These assets include physical assets (such as land, buildings, equipment, and machinery), as well as assets that represent property rights (such as accounts receivable, securities, patents, copyrights). When we refer to ***capital investment***, we are referring to the firm's investment in its assets.

The term "capital" also has come to mean the funds used to finance the firm's assets. In this sense, capital consists of notes, bonds, stock, and short-term financing. We use the term "capital structure" to refer to the mix of these different sources of capital used to finance a firm's assets.

The firm's capital investment decision may be comprised of a number of distinct decisions, each referred to as a project. A ***capital project*** is a set of assets that are contingent on one another and are considered together. For example, suppose a firm is considering the production of a new product. This capital project would require the firm to acquire land, build facilities, and purchase production equipment. And this project may also require the firm to increase its investment in its ***working capital***—inventory, cash, or accounts receivable. Working capital is the collection of assets needed for day-to-day operations that support a firm's long-term investments.

The investment decisions of the firm are decisions concerning a firm's capital investment. When we refer to a particular decision that financial managers must make, we are referring to a decision pertaining to a capital project.

Investment Decisions and Owners' Wealth Maximization

Managers must evaluate a number of factors in making investment decisions. Not only does the financial manager need to estimate how much the firm's future cash flows will change if it invests in a project, but the manager also must evaluate the uncertainty associated with these future cash flows.

We already know that the value of the firm today is the present value of all its future cash flows. But we need to understand better where these future cash flows come from. They come from:

- assets that are already in place, which are the assets accumulated as a result of all past investment decisions, and
- future investment opportunities.

The value of the firm is therefore,

Value of firm = Present value of all future cash flows
= Present value of cash flows from all assets in place
+ Present value of cash flows from future investment opportunities

Future cash flows are discounted at a rate that represents investors' assessments of the uncertainty that these cash flows will flow in the amounts and the timeframe expected. To evaluate the value of the firm, we need to evaluate the risk of these future cash flows.

Cash flow risk comes from two basic sources:

- ***Sales risk***, which is the degree of uncertainty related to the number of units that will be sold and the price of the good or service; and
- ***Operating risk***, which is the degree of uncertainty concerning operating cash flows that arises from the particular mix of fixed and variable operating costs.

Sales risk is related to the economy and the market in which the firm's goods and services are sold. Operating risk, for the most part, is determined by the product or service that the firm provides and is related to the sensitivity of operating cash flows to changes in sales. We refer to the combination of these two risks as ***business risk***.

A project's business risk is reflected in the discount rate, which is the rate of return required to compensate the suppliers of capital (bondholders and owners) for the amount of risk they bear. From the perspective of investors, the discount rate is the ***required rate of return*** (RRR). From the firm's perspective, the discount rate is the ***cost of capital***—what it costs the firm to raise a dollar of new capital.

For example, suppose a firm invests in a new project. How does the investment affect the firm's value? If the project generates cash flows that *just* compensate the suppliers of capital for the risk they bear on this project (that is, it earns the cost of capital), the value of the firm does not change. If the project generates cash flows *greater* than needed to compensate them for the risk they take on, it earns more than the cost of capital, increasing the value of the firm. If the project generates cash flows *less* than needed, it earns less than the cost of capital, decreasing the value of the firm.

How do we know whether the cash flows are more than or less than needed to compensate for the risk that they will indeed need? If we discount all the cash flows at the cost of capital, we can assess how this project affects the present value of the firm. If the expected change in the value of the firm from an investment is:

- positive, the project returns more than the cost of capital;
- negative, the project returns less than the cost of capital;
- zero, the project returns the cost of capital.

Capital budgeting is the process of identifying and selecting investments in long-lived assets, or assets expected to produce benefits over more than one year. In Chapter 13, we discuss how to evaluate cash flows in deciding whether or not to invest. We cover how to determine cash flow risk and factor this risk into capital budgeting decisions in Chapter 14.

CAPITAL BUDGETING

Because a firm must continually evaluate possible investments, capital budgeting is an ongoing process. However, before a firm begins thinking about capital budgeting, it must first determine its ***corporate strategy***—its broad set of objectives for future investment. For example, the Quantum Corporation's goal is to "... be the leading mass storage company in the world....In order for Quantum to achieve our goals, we must build and maintain leadership positions in all of our businesses—in profitability, as well as in market share."[1]

Consider the corporate strategy of Mattel, Inc., manufacturer of toys such as Barbie and Disney toys. Mattel's strategy is to become a full-line toy company and grow through expansion into the international toy market. In the early 1990s, Mattel entered into the activity toy, games, and plush toy markets, and, through acquisitions in Mexico, France, and

[1] *Quantum Corporation 1996 Annual Report*, pp. 4–5.

Japan, increased its presence in the international toy market.[2] By 2001, Mattel generated over 30% of its revenues from its non-U.S. sales.[3]

How does a firm achieve its corporate strategy? By making investments in long-lived assets that will maximize owners' wealth. Selecting these projects is what capital budgeting is all about.

Stages in the Capital Budgeting Process

There are five stages in the capital budgeting process.

Stage 1: *Investment screening and selection*
Projects consistent with the corporate strategy are identified by production, marketing, and research and development management of the firm. Once identified, projects are evaluated and screened by estimating how they affect the future cash flows of the firm and, hence, the value of the firm.

Stage 2: *Capital budget proposal*
A capital budget is proposed for the projects surviving the screening and selection process. The budget lists the recommended projects and the dollar amount of investment needed for each. This proposal may start as an estimate of expected revenues and costs, but as the project analysis is refined, data from marketing, purchasing, engineering, accounting, and finance functions are put together.

Stage 3: *Budgeting approval and authorization*
Projects included in the capital budget are authorized, allowing further fact gathering and analysis, and approved, allowing expenditures for the projects. In some firms, the projects are authorized and approved at the same time. In others, a project must first be authorized, requiring more research before it can be formally approved. Formal authorization and approval procedures are typically used on larger expenditures; smaller expenditures are at the discretion of management.

Stage 4: *Project tracking*
After a project is approved, work on it begins. The manager reports periodically on its expenditures, as well as on any revenues associated with it. This is referred to as ***project tracking***, the communication link between the decision makers and the operating management of the firm. For example: tracking can identify cost overruns and uncover the need for more marketing research.

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[2] *Mattel, Inc., 1991 Annual Report*, pp. 4–5, 15.
[3] *Mattel, Inc., 2001 Annual Report*, p.11.

Stage 5: *Post-completion audit*
Following a period of time, perhaps two or three years after approval, projects are reviewed to see whether they should be continued. This re-evaluation is referred to as a ***post-completion audit***. Thorough post-completion audits are typically performed on selected projects, usually the largest projects in a given year's budget for the firm or for each division. Post-completion audits show the firm's management how well the cash flows realized correspond with the cash flows forecasted several years earlier.

Classifying Investment Projects

In this section, we discuss different ways managers classify capital investment projects. One way of classifying projects is by project life, whether short-term or long-term. We do this because in the case of long-term projects, the time value of money plays an important role in long-term projects. Another way of classifying projects is by their risk. The riskier the project's future cash flows, the greater the role of the cost of capital in decision-making. Still another way of classifying projects is by their dependence on other projects. The relationship between a project's cash flows and the cash flows of some other project of the firm must be incorporated explicitly into the analysis since we want to analyze how a project affects the total cash flows of the firm.

Classification According to Their Economic Life

An investment generally provides benefits over a limited period of time, referred to as its economic life. The ***economic life*** or ***useful life*** of an asset is determined by:

- physical deterioration;
- obsolescence; or
- the degree of competition in the market for a product.

The economic life is an estimate of the length of time that the asset will provide benefits to the firm. After its useful life, the revenues generated by the asset tend to decline rapidly and its expenses tend to increase.

Typically, an investment requires an immediate expenditure and provides benefits in the form of cash flows received in the future. If benefits are received only within the current period—within one year of making the investment—we refer to the investment as a ***short-term investment***. If these benefits are received beyond the current period, we refer to the investment as a ***long-term investment*** and refer to the

expenditure as a ***capital expenditure***. An investment project may comprise one or more capital expenditures. For example, a new product may require investment in production equipment, a building, and transportation equipment.

Short-term investment decisions involve, primarily, investments in current assets: cash, marketable securities, accounts receivable, and inventory. The objective of investing in short-term assets is the same as long-term assets: maximizing owners' wealth. Nevertheless, we consider them separately for two practical reasons:

1. Decisions about long-term assets are based on projections of cash flows far into the future and require us to consider the time value of money.
2. Long-term assets do not figure into the daily operating needs of the firm.

Decisions regarding short-term investments, or current assets, are concerned with day-to-day operations. And a firm needs some level of current assets to act as a cushion in case of unusually poor operating periods when cash flows from operations are less than expected.

Classification According to Their Risk

Suppose you are faced with two investments, A and B, each promising a $100 cash inflow ten years from today. If A is riskier than B, what are they worth to you today? If you do not like risk, you would consider A less valuable than B because the chance of getting the $100 in ten years is less for A than for B. Therefore, valuing a project requires considering the risk associated with its future cash flows.

The investment's risk of return can be classified according to the nature of the project represented by the investment:

- *Replacement projects:* investments in the replacement of existing equipment or facilities.
- *Expansion projects:* investments in projects that broaden existing product lines and existing markets.
- *New products and markets:* projects that involve introducing a new product or entering into a new market.
- *Mandated projects:* projects required by government laws or agency rules.

Replacement projects include the maintenance of existing assets to continue the current level of operating activity. Projects that reduce costs, such as replacing old equipment or improving the efficiency, are

also considered replacement projects. To evaluate replacement projects we need to compare the value of the firm with the replacement asset to the value of the firm without that same replacement asset. What we're really doing in this comparison is looking at ***opportunity costs***: what cash flows would have been if the firm had stayed with the old asset.

There's little risk in the cash flows from replacement projects. The firm is simply replacing equipment or buildings already operating and producing cash flows. And the firm typically has experience in managing similar new equipment.

Expansion projects, which are intended to enlarge a firm's established product or market, also involve little risk. However, investment projects that involve introducing new products or entering into new markets are riskier because the firm has little or no management experience in the new product or market.

A firm is forced or coerced into its mandated projects. These are government-mandated projects typically found in "heavy" industries, such as utilities, transportation, and chemicals, all industries requiring a large portion of their assets in production activities. Government agencies, such as the Occupational Health and Safety Agency (OSHA) or the Environmental Protection Agency (EPA), may impose requirements that firms install specific equipment or alter their activities (such as how they dispose of waste).

We can further classify mandated projects into two types: contingent and retroactive. Suppose, as a steel manufacturer, we are required by law to include pollution control devices on all smoke stacks. If we are considering a new plant, this mandated equipment is really part of our new plant investment decision—the investment in pollution control equipment is contingent on our building the new plant.

On the other hand, if we are required by law to place pollution control devices on existing smoke stacks, the law is retroactive. We do not have a choice. We must invest in the equipment whether it increases the value of the firm or not. In this case we either select from among possible equipment that satisfies the mandate, or we weigh the decision whether to halt production in the offending plant.

Classification According to Their Dependence on Other Projects

In addition to considering the future cash flows generated by a project, a firm must consider how it affects the assets already in place—the results of previous project decisions—as well as other projects that may be undertaken. Projects can be classified as follows according to the degree of dependence with other projects: independent projects, mutually exclusive projects, contingent projects, and complementary projects.

An ***independent project*** is one whose cash flows are not related to the cash flows of any other project. Accepting or rejecting an independent project does not affect the acceptance or rejection of other projects. Projects are ***mutually exclusive*** if the acceptance of one precludes the acceptance of other projects. For example, suppose a manufacturer is considering whether to replace its production facilities with more modern equipment. The firm may solicit bids among the different manufacturers of this equipment. The decision consists of comparing two choices, either keeping its existing production facilities or replacing the facilities with the modern equipment of one manufacturer. Because the firm cannot use more than one production facility, it must evaluate each bid and choose the most attractive one. The alternative production facilities are mutually exclusive projects: the firm can accept only one bid.

Contingent projects are dependent on the acceptance of another project. Suppose a greeting card company develops a new character, Pippy, and is considering starting a line of Pippy cards. If Pippy catches on, the firm will consider producing a line of Pippy T-shirts—but *only* if the Pippy character becomes popular. The T-shirt project is a contingent project.

Another form of dependence is found in ***complementary projects***, where the investment in one enhances the cash flows of one or more other projects. Consider a manufacturer of personal computer equipment and software. If it develops new software that enhances the abilities of a computer mouse, the introduction of this new software may enhance its mouse sales as well.

CASH FLOW FROM INVESTMENTS

A firm invests only to increase the value of their ownership interest. A firm will have cash flows in the future from its past investment decisions. When it invests in new assets, it expects the future cash flows to be *greater than without this new investment*.

Incremental Cash Flows

The difference between the cash flows of the firm *with* the investment project and the cash flows of the firm *without* the investment project—both over the same period of time—is referred to as the project's ***incremental cash flows***.

To evaluate an investment, we'll have to look at how it will change the future cash flows of the firm, and, hence, the value of the firm.

The change in a firm's value as a result of a new investment is the difference between its benefits and its costs:

Project's change in the value of the firm = Project's benefits – Project's costs

A more useful way of evaluating the change in the value is the breakdown of the project's cash flows into two components:

1. The present value of the cash flows from the project's operating activities (revenues minus operating expenses), referred to as the project's ***operating cash flows*** (OCF); and
2. The present value of the ***investment cash flows***, which are the expenditures needed to acquire the project's assets and any cash flows from disposing the project's assets.

or,

Change in the value of the firm
= Present value of the change in operating cash flows provided by the project
+ Present value of investment cash flows

The present value of a project's operating cash flows is typically positive (indicating predominantly cash inflows) and the present value of the investment cash flows is typically negative (indicating predominantly cash outflows).

Investment Cash Flows

When we consider the cash flows of an investment we must also consider all the cash flows associated with acquiring and disposing of assets in the investment. Let's first become familiar with cash flows related to acquiring assets; then we'll look at cash flows related to disposing of assets.

Asset Acquisition

In acquiring any asset, there are three types of cash flows to consider:

1. Cost of the asset,
2. Set-up expenditures, including shipping and installation; and
3. Any tax credit.

The tax credit may be an investment tax credit or a special credit—such as a credit for a pollution control device—depending on the prevailing tax law.

Cash flow associated with acquiring an asset is:

Cash flow from acquiring assets = Cost + Set-up expenditures – Tax credit

Suppose the firm buys equipment that costs $100,000 and it costs $10,000 to install it. If the firm is eligible for a 10% tax credit on this equipment (that is, 10% of the total cost of buying and installing the equipment) the change in the firm's cash flow from acquiring the asset of $99,000 is as follows:

Cash flow from acquiring assets
= $100,000 + $10,000 – 0.10($100,000 + $10,000)
= $100,000 + $10,000 – $11,000 = $99,000

The cash outflow is $99,000 when this asset is acquired: $110,000 *out* to buy and install the equipment and $11,000 *in* from the reduction in taxes.

What about expenditures made in the past for assets or research that would be used in the project we're evaluating? Suppose the firm spent $1,000,000 over the past three years developing a new type of toothpaste. Should the firm consider this $1,000,000 spent on research and development when deciding whether to produce this new project we are considering? No: These expenses have already been made and do not affect how the new product changes the future cash flows of the firm. We refer to this $1,000,000 as a ***sunk cost*** and do not consider it in the analysis of our new project. Whether or not the firm goes ahead with this new product, this $1,000,000 has been spent. A sunk cost is any cost that has already been incurred that does not affect future cash flows of the firm.

Let's consider another example. Suppose the firm owns a building that is currently empty. Let's say the firm suddenly has an opportunity to use it for the production of a new product. Is the cost of the building relevant to the new product decision? The cost of the building itself is a sunk cost since it was an expenditure made as part of some *previous* investment decision. The cost of the building does not affect the decision to go ahead with the new product.

We have assumed that the building is empty and there is no opportunity to sell the building. In this case, the building's cost is truly a sunk cost. But if the company intended to sell the building, instead of leaving it empty, the foregone sales price of the building is an opportunity cost associated with the new product.

Suppose the firm was using the building in some way producing cash (say, renting it) and the new project is going to take over the entire building. The cash flows given up represent opportunity costs that must be included in the analysis of the new project. However, these forgone cash flows are not asset acquisition cash flows. Because they represent operating cash flows that could have occurred but will not because of the new project, they must be considered part of the project's future operating cash flows.

Further, if we incur costs in renovating the building to manufacture the new product, the renovation costs are relevant and should be included in our asset acquisition cash flows.

Asset Disposition

At the end of the useful life of an asset, the firm may be able to sell it or may have to pay someone to haul it away. If the firm is making a decision that involves replacing an existing asset, the cash flow from disposing of the old asset must be figured in since it is a cash flow relevant to the acquisition of the new asset.

If the firm disposes of an asset, whether at the end of its useful life or when it is replaced, two types of cash flows must be considered:

1. what you receive or pay in disposing of the asset; and
2. any tax consequences resulting from the disposal.

Cash flow from disposing assets
= Proceeds or payment from disposing assets
– Taxes from disposing assets

The proceeds are what you expect to sell the asset for if you can get someone to buy it. If the firm must pay for the disposal of the asset, this cost is a cash outflow.

Consider the investment in a gas station. The current owner wants to sell the station to another gas station proprietor. But if a buyer cannot be found and the station abandoned, the current owner may be required to remove the underground gasoline storage tanks to prevent environmental damage. Thus, a cost is incurred at the end of the asset's life.

The tax consequences are a bit more complicated. Taxes depend on: (1) the expected sales price, (2) the book value of the asset for tax purposes at the time of disposition, and (3) the tax rate at the time of disposal.

If a firm sells the asset for more than its book value but less than its original cost, the difference between the sales price and the book value for tax purposes (called the ***tax basis***) is a gain, taxable at ordinary tax rates. If a firm sells the asset for more than its original cost, then the gain is broken into two parts:

1. *Capital gain:* the difference between the sales price and the original cost; and
2. *Recapture of depreciation:* the difference between the original cost and the tax basis.

The ***capital gain*** is the benefit from the appreciation in the value of the asset and may be taxed at special rates, depending on the tax law at the time of sale. The ***recapture of depreciation*** represents the amount by which the firm has *over*depreciated the asset during its life. This means that more depreciation has been deducted from income (reducing taxes) than necessary to reflect the usage of the asset. The recapture portion is taxed at the ordinary tax rates, since the excess depreciation taken all these years has reduced taxable income.

If a firm sells an asset for less than its book value, the result is a ***capital loss***. In this case, the asset's value has decreased by more than the amount taken for depreciation for tax purposes. A capital loss is given special tax treatment:

- If there are capital gains in the same tax year as the capital loss, they are combined, so that the capital loss reduces the taxes paid on capital gains, and
- If there are no capital gains to offset against the capital loss, the capital loss is used to reduce ordinary taxable income.

The benefit from a loss on the sale of an asset is the amount by which taxes are reduced. The reduction in taxable income is referred to as a ***tax shield***, since the loss *shields* some income from taxation. If the firm has a loss of $1,000 on the sale of an asset and has a tax rate of 40%, this means that its taxable income is $1,000 less and its taxes are $400 less than they would have been without the sale of the asset.

Suppose you are evaluating an asset that costs $10,000 that you expect to sell in five years. Suppose further that the tax basis of the asset for tax purposes will be $3,000 after five years and that the firm's tax rate is 40%. What are the expected cash flows from disposing this asset?

If the firm expects to sell the asset for $8,000 in five years, $10,000 – $3,000 = $7,000 of the asset's cost will be depreciated; yet the asset lost only $10,000 – $8,000 = $2,000 in value. Therefore, the firm has overdepreciated the asset by $5,000. Because this overdepreciation represents deductions to be taken on the firm's tax returns over the five years that don't reflect the actual depreciation in value (the asset doesn't lose $7,000 in value, only $2,000), this $5,000 is taxed at ordinary tax rates. If the firm's tax rate is 40%, the tax will be 40% × $5,000 = $2,000.

The cash flow from disposition is the sum of the direct cash flow (someone pays us for the asset or the firm pays someone to dispose of it) and the tax consequences. In this example, the cash flow is the $8,000 we expect someone to pay the firm for the asset, less the $2,000 in taxes we expect the firm to pay, or $6,000 cash inflow.

Suppose instead that the firm expects to sell this asset in five years for $12,000. Again, the asset is overdepreciated by $7,000. In fact, the asset is not expected to depreciate, but rather *appreciate* over the five years. The $7,000 in depreciation is recaptured after five years and taxed at ordinary rates: 40% of $7,000, or $2,800. The $2,000 capital gain is the appreciation in the value of the asset and may be taxed at special rates. If the tax rate on capital gain income is 30%, you expect the firm to pay 30% of $2,000, or $600 in taxes on this gain. Selling the asset in five years for $12,000 therefore results in an expected cash inflow of $12,000 – $2,800 – $600 = $8,600.

Suppose the firm expects to sell the asset in five years for $1,000. If the firm can reduce its ordinary taxable income by the amount of the capital loss, $3,000 – $1,000 = $2,000, its tax bill will be 40% of $2,000, or $800 because of this loss. We refer to this reduction in the taxes as a tax shield, since the loss "shields" $2,000 of income from taxes. Combining the $800 tax reduction with the cash flow from selling the asset, the $1,000, gives the firm a cash inflow of $1,800.[4]

The calculation of the cash flow from disposition for the alternative sales prices of $8,000, $12,000, and $1,000 are shown in Exhibit 12.1.

EXHIBIT 12.1 Expected Cash Flows from the Disposition of an Asset

The firm pays $10,000 for an asset and expects to dispose of it in five years, when the asset has a book value of $3,000. The firm's ordinary tax rate is 40% and the tax rate on capital gains is 30%.

Original cost > Expected sales price > Tax Basis

Tax on disposition:	
Sales price	$8,000
Tax basis	3,000
Gain	$5,000
Ordinary tax rate	0.40
Tax on recapture	$2,000
Cash flows:	
Proceeds from disposition	$8,000
Less tax on gain	2,000
Cash flow on disposition	$6,000

[4] On the other hand, if the firm expects other capital gains five years from now, the amount of the tax shield would be less since this loss would be used to first offset any capital gains taxed at 30%. In this case, the expected tax shield is only 30% of $2,000, or $600 because we must first use the capital loss to reduce any capital gains.

EXHIBIT 12.1 (Continued)

Expected sales price > Original cost > Tax basis

Tax on disposition:

Sales price	$12,000
Original cost	10,000
Capital gain	$2,000
Capital gains tax rate	0.30
Tax on capital gain	$600
Original cost	$10,000
Tax basis	3,000
Gain (recapture)	$7,000
Ordinary tax rate	0.40
Tax on recapture	$2,800

Cash flows:

Proceeds from disposition	$12,000
Less tax on capital gain	600
Less tax on recapture	2,800
Cash flow on disposition	$8,600

Tax basis > Expected sales price

Tax shield on disposition:

Book value	$3,000
Tax basis	1,000
Loss	$2,000
Ordinary tax rate	0.40
Tax shield on loss	$800

Cash flows:

Proceeds from disposition	$1,000
Plus tax shield on loss	800
Cash flow on disposition	$1,800

Let's also not forget about disposing of any existing assets. Suppose the firm bought equipment ten years ago and at that time expected to be able to sell it 15 years later for $10,000. If the firm decides *today* to replace this equipment, it must consider what it is giving up by *not* dis-

posing of an asset *as planned*. If the firm does not replace the equipment today, it would continue to depreciate it for five more years and then sell it for $10,000; if the firm replaces the equipment today, it would not have five more years' depreciation on the replaced equipment and it would not have $10,000 in five years (but perhaps some other amount today). This $10,000 in five years, less any taxes, is a foregone cash flow that we must figure into the investment cash flows. Also, the depreciation the firm would have had on the replaced asset must be considered in analyzing the replacement asset's operating cash flows.

Operating Cash Flows

As we saw in the previous section, in the simplest form of investment there is a cash outflow when the asset is acquired and there may be either a cash inflow or an outflow at the end of its economic life. In most cases these are not the only cash flows—the investment may result in changes in revenues, expenditures, taxes, and working capital. These are ***operating cash flows*** since they result directly from the operating activities—the day-to-day activities of the firm.

What we are after here are *estimates* of operating cash flows. We cannot know for certain what these cash flows will be in the future, but we must attempt to estimate them. What is the basis for these estimates? We base them on marketing research, engineering analyses, operations research, analysis of our competitors—and our managerial experience.

Change in Revenues

Suppose you are a financial analyst for a food processor considering a new investment in a line of frozen dinner products. If you introduce a new ready-to-eat dinner product, your marketing research will indicate how much you should expect to sell. But where do these new product sales come from? Some may come from consumers who do not already buy ready-to-eat products. But some sales may come from consumers who choose to buy other types of ready-to-eat products. It would be nice if these consumers are giving up buying your competitors' ready-to-eat dinners. Yet some of them may be giving up buying your company's other ready-to-eat dinner products. So, when you introduce a new product, you are really interested in how it changes the sales of the entire firm (that is, the incremental sales), rather than the sales of the new product alone.

We also need to consider any foregone revenues—opportunity costs—related to an investment. Suppose a firm owns a building currently being rented to another firm. If we are considering terminating that rental agreement so we can use the building for a new project, we need to consider the foregone rent—what we would have earned from

the building. Therefore, the revenues from the new project are really only the additional revenues—the revenues from the new project minus the revenue we could have earned from renting the building.

So, when a firm undertakes a new project, the financial managers want to know how it changes the firm's total revenues, not merely the new product's revenues.

Change in Expenses

When a firm takes on a new project, the costs associated with it will change the firm's expenses. If the investment changes the sales of an existing product, the decision maker must estimate the change in unit sales. Based on that estimate, the estimate of the additional costs of producing the additional number of units is derived by consulting with production management. In addition, an estimate of how the product's inventory may change when production and sales of the product change is also needed.

If the investment involves changes in the costs of production, we compare the costs without this investment with the costs with this investment. For example, if the investment is the replacement of an assembly line machine with a more efficient machine, we need to estimate the change in the firm's overall production costs such as electricity, labor, materials, and management costs.

A new investment may change not only production costs but also operating costs, such as rental payments and administration costs. Changes in operating costs as a result of a new investment must be considered as part of the changes in the firm's expenses.

Increasing cash expenses are cash outflows, and decreasing cash expenses are cash inflows.

Change in Taxes

Taxes figure into the operating cash flows in two ways. First, if revenues and expenses change, taxable income and therefore, taxes change. That means we need to estimate the change in taxable income resulting from the changes in revenues and expenses resulting from a new project to determine the effect of taxes on the firm.

Second, the deduction for depreciation reduces taxes. Depreciation itself is not a cash flow, but depreciation reduces the taxes that must be paid, shielding income from taxation. The tax shield from depreciation is like a cash inflow.

Suppose a firm is considering a new product that is expected to generate additional sales of $200,000 and increase expenses by $150,000. If the firm's tax rate is 40%, considering only the change in sales and

expenses, taxes go up by $50,000 × 40% or $20,000. This means that the firm is expected to pay $20,000 more in taxes because of the increase in revenues and expenses.

Let's change this around and consider that the product will generate $200,000 in revenues and $250,000 in expenses. Considering only the change in revenues and expenses, if the tax rate is 40%, taxes go *down* by $50,000 × 40%, or $20,000.[5] This means that we reduce our taxes by $20,000, which is like having a cash inflow of $20,000 from taxes.

Now, consider depreciation. When a firm buys an asset that produces income, the tax laws allow it to depreciate the asset, reducing taxable income by a specified percentage of the asset's cost each year. By reducing taxable income, the firm is reducing its taxes. The reduction in taxes is like a cash inflow since it reduces the firm's cash outflow to the government.

Suppose a firm has taxable income of $50,000 before depreciation and a flat tax rate of 40%. If the firm is allowed to deduct depreciation of $10,000, how has this changed the taxes it pays?

	Without Depreciation	With Depreciation
Taxable income	$50,000	$40,000
Tax rate	0.40	0.40
Taxes	$20,000	$16,000

Depreciation *reduces* the firm's tax-related ***cash outflow*** by $20,000 – $16,000 = $4,000 or, equivalently, by $10,000 × 40% = $4,000. A reduction is an outflow (taxes in this case) is an inflow. We refer to the effect depreciation has on taxes as the ***depreciation tax shield***.

Depreciation itself is not a cash flow. But in determining cash flows, we are concerned with the effect depreciation has on our taxes—and we all know that taxes are a cash outflow. Because depreciation reduces taxable income, depreciation reduces the tax outflow, which amounts to a cash inflow. For tax purposes, firms are permitted to use accelerated depreciation (specifically the rates specified under the Modified Accelerated Cost Recovery System [MACRS]) or straight-line. An accelerated method is preferred in most situations since it results in larger deductions

[5] This loss creates an immediate cash inflow *if* (1) the firm has other income in the same tax year to apply the $50,000 loss against, or (2) the firm has income in prior tax years so it can carry back this loss and apply for a refund of prior year's taxes. Otherwise, this loss is carried forward to reduce future tax years' income. In this case, this loss is worth less because the benefit from the loss (the reduction in taxable income) is realized in the future, not today.

sooner in the asset's life than using straight-line depreciation. Therefore, accelerated depreciation, if available, is preferable to straight-line due to the time value of money.

Under the present tax code, assets are depreciated to a zero book value. Salvage value—what we expect the asset to be worth at the end of its life—is not considered in calculating depreciation. So is salvage value totally irrelevant to the analysis? No. Salvage value is our best guess today of what the asset will be worth at the end of its useful life some time in the future. Salvage value is our estimate of how much we can get when we dispose of the asset. Just remember you can ignore it to figure depreciation for tax purposes.

Let's look at another depreciation example, this time considering the effects that replacing an asset has on the depreciation tax shield cash flow. Suppose you are replacing a machine that you bought five years ago for $75,000. You were depreciating this old machine using straight-line depreciation over ten years, or $7,500 depreciation per year. If you replace it with a new machine that costs $50,000 and is depreciated over five years, or $10,000 each year, how does the change in depreciation affect the cash flows if the firm's tax rate is 30%?

We can calculate the effect two ways:

1. We can compare the depreciation and related tax shield from the old and the new machines. The depreciation tax shield on the old machine is 30% of $7,500, or $2,250. The depreciation tax shield on the new machine is 30% of $10,000, or $3,000. Therefore, the change in the cash flow from depreciation is $3,000 – $2,250 = $750.
2. We can calculate the change in depreciation and calculate the tax shield related to the change in depreciation. The change in depreciation is $10,000 – 7,500 = $2,500. The change in the depreciation tax shield is 30% of $2,500, or $750.

Let's look at another example. Suppose a firm invests $50,000 in an asset. And suppose the firm has a choice of depreciating the asset using either:

- An accelerated method over four years, with the rates of 33.33%, 44.45%, 14.81%, and 7.41%, respectively, where these depreciation rates are a percentage of the original cost of the asset; or
- The straight-line method over four years.

If the firm's tax rate is 40% and the cost of capital is 10%, what is the present value of the difference in the cash flows from the depreciation tax shield each year? It is $796 as shown below:

Year	Depreciation Using the Accelerated Method	Depreciation Using the Straight-Line Method	Difference in Depreciation	Difference in Depreciation Tax Shield	Present Value of Difference
First	$16,665	$12,500	$4,165	$1,666	$1,515
Second	22,225	12,500	9,725	3,890	3,215
Third	7,405	12,500	–5,095	–2,038	–1,531
Fourth	3,705	12,500	–8,795	–3,518	–2,403
	$50,000	$50,000	$0	$0	$796

Using both the accelerated and straight-line methods, the entire asset's cost is depreciated over the four years. But the accelerated method provides greater tax shields in the first and second years than the straight-line method. Since larger depreciation tax shields are generated under the accelerated method in the earlier years, the present value of the tax shields using the accelerated method is more valuable than the present value of the tax shields using the straight-line method. How much more? $796.

Change in Working Capital

Working capital consists of short-term assets, also referred to as current assets, that support the day-to-day operating activity of the business. ***Net working capital*** is the difference between current assets and current liabilities. Net working capital is what would be left over if the firm had to pay off its current obligations using its current assets.

The adjustment we make for changes in net working capital is attributable to two sources:

1. A change in current asset accounts for transactions or precautionary needs; and
2. The use of the accrual method of accounting.

An investment may increase the firm's level of operations, resulting in an increase in the net working capital needed. If the investment is to produce a new product, the firm may have to invest more in inventory (raw materials, work-in-process, and finished goods). If increasing sales means extending more credit, then the firm's accounts receivable will increase. If the investment requires maintaining a higher cash balance to handle the increased level of transactions, the firm will need more cash. If the investment makes the firm's production facilities more efficient, it may be able to reduce the level of inventory.

Because of an increase in the level of transactions, the firm may want to keep more cash and inventory on hand. As the level of operations increase, the effect of any fluctuations in demand for goods and services may increase, requiring the firm to keep additional cash and inventory "just in case." The firm may also increase working capital as a precaution because if there is greater variability of cash and inventory, a greater safety cushion will be needed. On the other hand, if a project enables the firm to be more efficient or lowers costs, it may lower its investment in cash, marketable securities, or inventory, releasing funds for investment elsewhere.

We also use the change in working capital to adjust accounting income (revenues less expenses) to a cash basis because cash flow is ultimately what we are valuing, not accounting numbers. But since we generally have only the accounting numbers to work from, we use this information, making adjustments to arrive at cash.

To see how this works, let's look at the cash flow from sales. Not every dollar of sales is collected in the year of sale: Some customers may pay later. This means that the annual sales figure does not represent the cash inflow from sales, because some of these sales are collected in the next period. This also means that at the end of the year, there will be some accounts receivable from customers who have not paid yet.

For example, suppose you expect sales in the first year to increase by $20,000 per month and customers typically take 30 days to pay. The change in cash flow from sales in the first year is not $20,000 × 12 = $240,000, but rather $20,000 × 11 = $220,000 because one month's worth of sales has not been collected in cash by the end of the year. You adjust for the difference between what is sold and what is collected in cash by keeping track of the change in working capital, which in this case is the increase in accounts receivable, as shown below:

Change in revenues	$240,000
Less: increase in accounts receivable	20,000
Change in cash inflow from sales	$220,000

On the other side of the balance sheet, if the firm increases its purchases of raw materials and incurs higher production costs, such as labor, the firm may increase its level of short-term liabilities, such as accounts payable and salary and wages payable. Suppose expenses for materials and supplies are forecasted at $10,000 per month for the first year and it takes the firm 30 days to pay. Expenses for the first year are $10,000 × 12 = $120,000, yet cash outflow for these expenses is only $10,000 × 11 = $110,000. Accounts payable increases by $10,000, representing one month's of expenses. The increase in net working capital

(increase in accounts payable ⇒ increases current liabilities ⇒ decreases net working capital) reduces the cost of goods sold to give us the cash outflow from expenses:

Cost of goods sold	$120,000
Less: increase in accounts payable	10,000
Change in cash flow for expenses	$110,000

A new project may have one of three effects on working capital: an increase, a decrease, or no change. Furthermore, working capital may change at the beginning of the project or at any point during the life of the project. For example, as a new product is introduced, sales may be terrific in the first few years, requiring an increase in cash, accounts receivable, and inventory to support these increased sales. But all of this requires an increase in working capital—a cash outflow.

But later sales may fall off as competitors enter the market. As sales and production fall off, the need for the increased cash, accounts receivable, and inventory also falls off. As cash, accounts receivable, and inventory are reduced, there is a cash inflow in the form of the reduction in the funds that become available for other uses within the firm.

A change in net working capital can be thought of as part of the initial investment—the amount necessary to get the project going. Or it can be considered generally as part of operating activity—the day-to-day business of the firm. So where do we classify the cash flow associated with net working capital? With the asset acquisition and disposition represented in the new project, or with the operating cash flows?

If a project requires a change in the firm's net working capital accounts that persists for the duration of the project—say, an increase in inventory levels starting at the time of the investment—we tend to classify the change as part of the acquisition costs at the beginning of the project and as part of disposition proceeds at the end of project. If, on the other hand, the change in net working capital is due to the fact that accrual accounting does not coincide with cash flows, we tend to classify the change as part of the operating cash flows.

In many applications, however, we can arbitrarily classify the change in working capital as either investment cash flows or operating cash flows. And the classification doesn't really matter since it's the bottom line—the change in net cash flows—that matter. How we classify the change in working capital doesn't affect a project's attractiveness. For purposes of illustrating the calculation of cash flows, we will assume that changes in working capital occur only at the beginning and the end of the project's life. Therefore, changes in working capital will be classified along with acquisition and disposition cash flows in the examples in this chapter.

EXHIBIT 12.2 An Example of the Calculation of the Change in Operating Cash Flow

	Change in sales	$200,000
	Less: change in expenses	150,000
	Less: change in depreciation	10,000
Change in Taxable Income	Change in taxable income	$40,000
↓		
Adjust for the change in taxes	Less taxes	16,000
	Change in income after taxes	$24,000
↓		
Add back noncash expenses such as depreciation	Add: depreciation	10,000
↓		
Change in Operating Cash Flow	Change in operating cash flow	$34,000

Putting It All Together

Here's what we need to put together to calculate the change in the firm's operating cash flows related to a new investment we are considering:

- Changes in revenues and expenses;
- Cash flow from changes in taxes from changes in revenues and expenses;
- Cash flow from changes in cash flows from depreciation tax shields; and
- Changes in net working capital.

There are many ways of compiling the component cash flow changes to arrive at the change in operating cash flow. We will start by first calculating taxable income, making adjustments for changes in taxes, noncash expenses, and net working capital to arrive at operating cash flow.

Suppose you are evaluating a project that is expected to increase sales by $200,000 and expenses by $150,000. The project's assets will have a $10,000 depreciation expense for tax purposes. If the tax rate is 40%, what is the operating cash flow from this project? As you can see in Exhibit 12.2, the change in operating cash flow is $34,000.

When we can mathematically represent how to calculate the change in operating cash flows for a project, let's use the symbol "Δ" to indicate "change in":

ΔOCF = change in operating cash flow
ΔR = change in revenues

ΔE = change in expenses
ΔD = change in depreciation
τ = tax rate

The change in the operating cash flow is:

$$\Delta OCF = (\Delta R - \Delta E - \Delta D)(1 - \tau) + \Delta D \quad (12\text{-}1)$$

↑ Change in firm's operating cash flows; ↑ Change in after-tax income; ↑ Change in depreciation

We can also write this as:

$$\Delta OCF = (\Delta R - \Delta E)(1 - \tau) + \Delta D\tau \quad (12\text{-}2)$$

↑ Change in firm's operating cash flow; ↑ Change in after-tax income without considering depreciation; ↑ Change in depreciation tax shield

Applying equation (12-1) to the previous example,

$$\begin{aligned}\Delta OCF &= (\Delta R - \Delta E - \Delta D)(1 - \tau) + \Delta D \\ &= (\$200{,}000 - 150{,}000 - 10{,}000)(1 - 0.40) + \$10{,}000 \\ &= \$24{,}000\end{aligned}$$

or, using the rearrangement as in equation (12-2),

$$\begin{aligned}\Delta OCF &= (\Delta R - \Delta E)(1 - \tau) + \Delta D\tau \\ &= (\$200{,}000 - \$150{,}000)(1 - 0.40) + \$10{,}000(0.40) \\ &= \$24{,}000\end{aligned}$$

Let's look at one more example for the calculation of operating cash flows. Suppose you are evaluating modern equipment which you expect will reduce expenses by $100,000 during the first year. The old machine cost $200,000 and was depreciated using straight-line over ten years, with five years remaining. The new machine cost $300,000 and will be depreciated using straight-line over ten years. If the firm's tax rate is 30%, what is the expected operating cash flow in the first year?

Let's identify the components:

ΔR = $0 ⇦ The new machine does not affect revenues
ΔE = –$100,000 ⇦ The new machine reduces expenses which will reduce taxes and increase cash flows

ΔD = +\$10,000 ⇦ The new machine increases the depreciation expense from \$20,000 to \$30,000

τ = 30%

The operating cash flow from the first year is therefore:

$$\begin{aligned}\Delta OCF &= (\Delta R - \Delta E - \Delta D)(1 - \tau) + \Delta D \\ &= (\$100{,}000 - 10{,}000)(1 - 0.30) + \$10{,}000 \\ &= \$63{,}000 + \$10{,}000 = \$73{,}000\end{aligned}$$

Net Cash Flows

As we have seen, an investment's cash flows consist of two types of cash flows: (1) cash flows related to acquiring and disposing the assets represented in the investment and (2) cash flows related to operations. To evaluate any investment project, we must consider both cash flows.

The sum of the cash flows from asset acquisition and disposition and from operations is referred to as ***net cash flows*** (NCF). The net cash flows are therefore the incremental cash flows related to an investment. The net cash flow is calculated for each period of the project's life. In each period, we add the cash flow from asset acquisition and disposition and the cash flow from operations. For a given period,

Net cash flow
= (Investment cash flow + Change in operating cash flow (ΔOCF))

The analysis of the cash flows of investment projects can become quite complex. But by working through any problem systematically, line-by-line, you will be able to sort out the information and focus on those items that determine cash flows.

Simplifications

To actually analyze a project's cash flows, we need to make several simplifications:

- We assume that cash will flow into or out of the firm at certain points in time, typically at the end of the year, although we realize that cash actually flows into and out of the firm at irregular intervals.
- We assume that the assets are purchased and put to work immediately.
- By combining inflows and outflows in each period, we are assuming that all inflows and outflows in a given period have the same risk.

Because there are so many flows to consider, we focus on flows within a period (say a year), assuming they all occur at the end of the period. We assume this to reduce the number of things we have to keep track of. Whether or not this assumption matters depends on: (1) the difference between the actual time of cash flow and when we assume it flows at the end of the period (that is, a flow on January 2 is 364 days from December 31, but a flow on December 30 is only one day from December 31), and (2) the opportunity cost of funds. Also, assuming that cash flows occur at specific points in time simplifies the financial mathematics we use in valuing these cash flows.

Keeping track of the different cash flows of an investment project can be taxing. Developing a checklist of things to consider can help you wade through the analysis of a project's cash flows. Exhibit 12.3 provides a checklist for the new investment and the replacement investment decisions. When you begin your analysis of an investment decision, take a look at the appropriate checklist to make sure you've covered everything.

In the next two sections, we use two hypothetical examples to illustrate the net cash flow calculations. We then end the chapter by considering the problems of cash flow estimation in the real world.

INTEGRATIVE EXAMPLE 1: THE EXPANSION OF THE WILLIAMS 5 & 10

The Williams 5 & 10 Company is a discount retail chain, selling a variety of goods at low prices. Business has been very good lately and the Williams 5 & 10 Company is considering opening one more retail outlet in a neighboring town at the end of 2003. Management figures that it would be about five years before a large national chain of discount stores moves into that town to compete with its store. So it is looking at this expansion as a five-year prospect. After five years, it would most likely retreat from this town.

The Problem

Williams' managers have researched the expansion and determined that the building needed could be built for $400,000 and it would cost $100,000 to buy the equipment. Under MACRS, the building would be classified as 31.5-year property and depreciated using the straight-line method, with no salvage value. This means that $\frac{1}{31.5}$ of the $400,000 is depreciated each year. Also under MACRS, the equipment would be classified as five-year property. Management expects to be able to sell the building for $350,000 and the equipment for $50,000 after five years.

EXHIBIT 12.3 Capital Budgeting Checklists

Capital Budgeting Checklist Nonreplacement Decision

Investment Cash Flows:
- Asset cost
- Shipping and installation costs
- Asset disposition
- Tax effect of asset disposition

Operating Cash Flows:
- Change in firm's revenues
- Change in firm's expenses
- Tax on change in firm's revenues and expenses
- Depreciation on asset
- Tax shield from depreciation
- Change in working capital to adjust accounting income to cash flows

Capital Budgeting Checklist Replacement Decision

Investment Cash Flows:
- New asset cost
- Shipping and installation costs on new asset
- Old asset disposition
- Tax effect of old asset disposition
- New asset disposition
- Tax effect of new asset disposition
- Change in working capital (transactions or precautionary needs)

Operating Cash Flows:
- Change in firm's revenues
- Change in firm's expenses
- Tax on change in firm's revenues and expenses
- Change in depreciation (new versus old)
- Tax shield from change in depreciation
- Change in working capital to adjust accrual accounting to cash flows

The Williams 5 & 10 extends no credit on its sales and pays for all its purchases immediately. The projections for sales and expenses for the new store for the next five years are:

Year	Sales	Expenses
2004	$200,000	$100,000
2005	300,000	100,000
2006	300,000	100,000
2007	300,000	100,000
2008	50,000	20,000

The new store requires $50,000 of additional inventory. Because all sales are in cash, there is no expected increase in accounts receivable.

The tax rate is a flat 30% and there are no tax credits associated with this expansion. Also, capital gains are taxed at the ordinary tax rate.