Chapter 11

Capital Budgeting: The Basics

![Diagram: Calculation of Value]

**F**irms generate cash flows by using assets—without assets, there would be no sales, profits, or cash flows. However, some potential asset acquisitions represent good investments while others are likely to be losers, and the most successful firms are those that make the best asset investment decisions. “Capital budgeting” is the name given to the asset investment decision process. Conceptually, capital budgeting decisions are no different than decisions relating to stocks and bonds. When evaluating securities, cash flows (coupon payments, dividends, etc.) are estimated and then discounted at an appropriate rate (the YTM or YTC for bonds and the required return for stocks) to find the present value of the cash flow stream. In capital budgeting, projects require an initial investment (perhaps spread over multiple years) and then they produce positive operating cash flows over some period. These cash flows are then discounted back to the present at a weighted average cost of capital (WACC) sufficient to compensate investors for bearing the risk inherent in the project.

The capital budgeting process requires coordination between several departments within the company. Most projects involve large initial investments and have an ongoing need for funding to cover operating costs throughout their lives. Managers must estimate the product demand and determine optimal prices and quantities so as to maximize profits. The evolving nature of global markets complicates these decisions. In the past, firms generally operated and sold only in their home countries, with markets in other countries served primarily through exports. Today, though, multinational firms operate in both industrial economies and emerging markets, and the complexities of producing and selling in many sovereign countries make the analyses of investment projects much more difficult.
Conceptually, capital budgeting is similar for both purely domestic and multinational companies, and in both cases we apply our basic valuation equation. We first estimate the project’s investment requirements, both for acquiring productive assets and the related operating working capital, and this typically results in a negative cash flow at $t = 0$. For large projects that take several years to complete, there may be negative cash flows for several years, and in this instance the project’s cost is calculated as the present value (PV) of those negative cash flows. Next, we estimate the FCFs for each year and find their present value. Finally, we estimate funds the firm can recover from selling the equipment and liquidating the working capital at the end of the project’s operating life (the terminal value) and find their present value. The difference between the PV of the positive cash inflows and the PV of the project’s investment cost is defined as the net present value, or NPV, and it represents the value the proposed project is expected to add to the firm. If a project’s NPV is positive, then it increases the firm’s value and should be accepted.

While the basic tenets of domestic capital budgeting still hold, international capital budgeting must consider some additional factors. In particular, multinationals must contend with different accounting and tax systems, exchange rate fluctuations, and the repatriation of funds from foreign investments back to the parent. A further complication arises because the analysis can be performed from either a local subsidiary’s perspective or from the parent’s home market perspective. The focus in either case should be on maximizing the wealth of the parent’s shareholders, but the analysis itself is different depending on the perspective taken. This chapter covers the basics of capital budgeting in a global setting, while the next one goes on to bring in risk analysis and the role of real options in the capital budgeting decision process.

**Overview of Capital Budgeting**

**Capital budgeting** is the decision process used to identify those investment projects that are likely to add value to the firm, and it is perhaps the most important task faced by financial managers and their staffs. First, a firm’s capital budgeting decisions define its strategic direction because moves into new products, services, or markets must be preceded by capital expenditures. Second, the results of capital budgeting decisions continue for many years, thus reducing future flexibility. Third, poor capital budgeting can have serious financial consequences. If the firm invests too much, it will incur unnecessarily high depreciation and other expenses. On the other hand, if it does not invest enough, its equipment and computer software will become obsolete, and the firm will be unable to produce competitively. Also, if it has inadequate capacity, it may lose market share to rival firms, and regaining lost customers requires heavy selling expenses, price reductions, or product improvements, all of which are costly.

Security valuation concepts are also applied in capital budgeting. However, instead of investors selecting stocks and bonds from those available in the securities market, **capital budgeting projects are created by the firm**. For example, a sales representative may report that customers are asking for a product that the company does not currently produce. The sales manager then consults with the marketing research group to determine demand for the proposed product. If a significant market exists, cost accountants and engineers will estimate production costs. If management concludes that the product can generate sufficient profit, it will be formally proposed, and a project analysis will be conducted to verify that it will add value to the firm.
A firm’s growth, and even its ability to hold its current position, depends on a constant flow of ideas for new projects, product improvements, and lower cost alternatives. Accordingly, a well-managed firm encourages good capital budgeting proposals from its employees. If a firm has capable and imaginative employees and executives, and if it has an efficient incentive system, capital investment ideas will flow freely. Some ideas will be good, but others will not, so companies must screen projects to ensure that they invest only in those likely to add value.

Why are capital budgeting decisions so important?
What are some ways firms obtain ideas for capital projects?

**Project Classifications**

Analyzing capital expenditure proposals is not a costless operation—benefits can be gained, but analysis has a cost. For certain projects, a detailed analysis may be warranted; for others, simpler procedures should be used. Accordingly, firms generally categorize projects and then analyze those in each category somewhat differently:

1. *Replacement: maintenance of business.* Replacement of worn-out or damaged equipment is necessary for the firm to remain competitive. The only issues here are (a) should this operation be continued and (b) should we continue to use the same production processes? If the answers are yes, maintenance decisions are normally made without an elaborate analysis.

2. *Replacement: cost reduction.* These projects lower the costs of labor, materials, and other inputs (such as electricity) by replacing serviceable but less efficient equipment. These decisions are often discretionary, and they generally require a somewhat more detailed analysis.

3. *Expansion of existing products or markets, including international markets.* These decisions may include new outlets, distribution facilities, or products and are more complex because they require an explicit forecast of demand, so a significantly more detailed analysis is required. Also, the final decisions are generally made at a high level within the firm.

4. *Expansion into new products or markets, including international markets.* These projects involve strategic decisions that could change the fundamental nature of the business, and they normally require the expenditure of large sums with delayed paybacks. Decisions are usually made at the very top—by the board of directors—as part of the firm’s strategic plan.

5. *Downsizing and plant relocation decisions.* In recent years, many companies have found themselves with excess capacity, and studies have shown that closing some facilities and consolidating operations often increases profits. More and more, firms are concluding that closing domestic plants and moving production overseas will increase value.

Other types of projects include safety and/or environmental projects, research and development expenditures, or long-term contracts such as providing power to a military base where an initial investment is required to fulfill the contract.

In general, relatively simple calculations and only a few supporting documents are required for replacement decisions, especially maintenance-type investments in profitable plants. A more detailed analysis is required for cost-reduction replacements, for expansion of existing product lines, for investments in new products or areas, and for strategic relocation decisions. As we discussed in Chapter 4, international expansion can take several forms, including foreign direct investment (FDI),
joint ventures/strategic alliances, and licensing and management contracts. Given the complexities that can arise with international expansions, these decisions require especially careful analyses.

Identify the major project classification categories, and explain how the decision process varies among these categories.

**CAPITAL BUDGETING DECISION RULES**

The three most commonly used methods for evaluating projects are (1) payback, (2) net present value (NPV), and (3) internal rate of return (IRR). In the following sections we define each method, explain the calculations involved, and discuss how well each performs in terms of selecting the set of projects that will maximize the firm’s value.

**Payback Period**

The payback period, defined as the number of years required to recover the investment in a project, was the first formal method used in capital budgeting. For example, if a project has a cost of $90,000 and expected cash inflows of $30,000 at the end of each of the next five years, then the payback would be three years because it would take three years to recover the $90,000 investment. If the project had cost $100,000, then its payback would have occurred some time between the third and fourth years, and we would calculate the exact payback period using this formula:

\[
\text{Payback period} = \frac{\text{Year before full recovery} + \text{Unrecovered cost at start of year}}{\text{Cash flow during year}}.
\]

In our example with a $100,000 project cost, the payback would be 3.33 years. The shorter the payback, the better the project. Therefore, if we were comparing two projects, one with a payback of three years and the other five years, the three-year payback project would rank higher. If the projects were mutually exclusive, meaning that only one or the other could be accepted, the one with the shorter payback would be chosen. If the projects were independent, then both could be chosen, but if the company had a rule that required projects to have a payback of four years or less, then the three-year payback project would be accepted and the five-year project rejected.

Payback has three useful features: (1) It is simple to calculate; (2) it is easy to understand; and (3) it provides an indication of the “liquidity” of different projects by showing how long the firm’s money will be tied up. However, it also has three

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2When we use Equation 11-1, we are implicitly assuming that cash flows occur uniformly during the year at the rate of 1/365 per day. This is generally a reasonable assumption.

3An example of two mutually exclusive projects would be a conveyor belt system versus a fleet of forklifts for handling materials in a warehouse. Acceptance of one project would lower the cash flows from the other, so the projects’ cash flows are dependent on one another, not independent.
serious flaws: (1) Since it gives equal weight to dollars received in different years, it does not consider the time value of money; (2) it does not take account of cash flows that occur after the payback year; and (3) it does not have a profitability-based benchmark to differentiate between acceptable and unacceptable projects.4

Firms calculate payback because it does provide some useful information, but because of its flaws, it is not a reliable guide for selecting the set of projects that will maximize the firm’s value. Therefore, it is not given much weight in the final accept/reject decision in most regions of the world. Still, a majority of firms in India and Southeast Asia prefer the payback method to other more value-oriented measures because of its simplicity, low cost, and ease of explaining to upper management and also because firms in those regions often face severe liquidity constraints.

**Net Present Value (NPV)**

Once the flaws in the payback method were recognized, people began to search for better ways to evaluate projects. One obvious choice was the **net present value (NPV) method**, which utilizes the basic valuation equation. To implement this approach, we proceed as follows:

1. Find the present value of each cash flow, including both inflows and outflows, discounted at the project’s risk-adjusted cost of capital (the project’s WACC).
2. Sum these discounted cash flows to obtain the NPV.
3. If an independent project’s NPV is positive, accept it because it adds value to the firm, but reject the project if the NPV is negative. If two projects are mutually exclusive, the one with the higher positive NPV should be chosen.

The equation for the NPV is as follows:

\[
\text{Value added} = \text{NPV} = \sum_{t=0}^{n} \frac{CF_t}{(1 + \text{WACC})^t}
\]

Note that Equation 11-2 is a direct application of the basic valuation equation, where \( CF_t \) represents the expected cash flow at time \( t \), \( \text{WACC} \) is the project’s risk-adjusted cost of capital, and \( n \) is the project’s life. Expenditures for assets such as buildings and equipment, along with the working capital required to operate new plants, are negative cash flows, and they generally occur before inflows begin. For most small projects, only \( CF_0 \) is negative, but for many large projects, such as an electric generating plant or a newly designed jet aircraft, outflows occur for several years before operations commence and cash inflows begin. For example, Boeing’s new 7E7 aircraft is scheduled to fly in 2008, but the investment in that project began back in the 1990s.

To find a project’s NPV, we estimate its CFs, its WACC, and \( n \), after which we enter the data and solve the equation with a financial calculator or computer spreadsheet. An NPV of zero signifies that the project’s cash flows are just sufficient to repay the invested capital and provide the required rate of return on that capital. If the NPV is positive, then the project is expected to generate more cash flow than...

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4A variant of the payback, the discounted payback method, has been used to help overcome the time value of money problem. See Brigham and Daves, *Intermediate Financial Management*, for a discussion. We do not cover discounted payback here, but some firms rely heavily on it, particularly as an indicator of project risk.
is needed to cover its cost of capital, and the excess cash accrues to the firm’s stockholders and thus increases the firm’s value. Therefore, if a firm undertakes a project with a positive NPV, stockholder wealth increases by the project’s NPV. Viewed this way, it is easy to understand the logic of the NPV approach.5

**Internal Rate of Return (IRR)**

In Chapter 8 we found the yield to maturity on a bond as the discount rate that equates the present value of the expected future interest and principal payments to the bond’s current market price. If the expected yield exceeds the required rate of return, then the bond is a good investment. This same concept applies to capital budgeting. Here, the project’s cost corresponds to the bond price and the projected cash inflows correspond to the bond’s interest and maturity payments. We are looking for projects whose expected rates of return (IRRs) are greater than their required rates of return, which are their risk-adjusted WACCs. To find the **internal rate of return, IRR**, we use the same basic formula as for the NPV, except here we solve the equation for the discount rate. When we found the NPV, we entered values for the expected cash flows and the WACC for r, and we then solved for NPV. When we find the IRR, we again enter the CFs, but now we enter 0 for NPV and then solve for r, the discount rate. The solution value of r—the value that forces NPV to 0—is defined as the IRR.

\[
\text{Value added} = \text{NPV} = \frac{CF_0}{(1 + r)^0} + \frac{CF_1}{(1 + r)^1} + \frac{CF_2}{(1 + r)^2} + \ldots + \frac{CF_n}{(1 + r)^n}
\]

\[
0 = \sum_{t=0}^{n} \frac{CF_t}{(1 + IRR)^t}
\]

(11-3)

The IRR is not easy to calculate numerically, but it can be found easily with a financial calculator or spreadsheet.6

If a project’s IRR exceeds its cost of capital, then it will earn an extra return that accrues to stockholders, and this leads to a higher firm value. Therefore, under the **internal rate of return method**, all independent projects whose IRRs exceed their costs of capital should be accepted, and when choosing among mutually exclusive projects, the project with the highest IRR should be selected.

**Comparison of the NPV and IRR Methods**

The NPV and IRR criteria always lead to the same accept/reject decisions for independent projects.7 In other words, if the NPV is positive, then the IRR must exceed the WACC. However, NPV and IRR can give conflicting rankings for mutually exclusive projects. Moreover, mutually exclusive projects are extremely common—

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5A potential problem arises when using the NPV method to evaluate mutually exclusive projects that have different project lives. Methods such as the replacement chain or equivalent annual annuity must be employed. These methods are discussed in Brigham and Daves, *Intermediate Financial Management*.

6Most projects have negative cash flows (investment requirements) during the first year or perhaps the first few years, after which the sign of the cash flows changes from minus to plus. This is called a normal project. However, we occasionally encounter projects where the sign of the cash flows changes two or more times, as it might for a coal mining project where expenditures are required to open the mine, then cash inflows occur, and finally the company is required to spend money to clean up the mining site. This situation is defined as a nonnormal project. A complication can arise when we attempt to calculate the IRR for a nonnormal project—it may turn out that the project has two or more IRRs, or perhaps no IRR. The easiest way to deal with such a situation is to forget the IRR method and simply focus on the NPV. Alternatively, we can calculate the modified IRR (MIRR) or the rate of return on capital (RORC). For a discussion of multiple IRRs, see Brigham and Daves, *Intermediate Financial Management*.

7This assumes that the IRR exists and is unique. This may not always be the case, as explained in Footnote 6.
there is almost always more than one way to do something, and when there is, we have mutually exclusive projects.

Consider Figure 11-1. Here we examine two projects, S and L. Focus first on Project S, and look at the graph in Panel A of the figure. That graph is called a net present value profile, and it shows the project’s NPV at different costs of capital. Notice that NPV declines as the discount rate increases, and the rate where NPV = 0 is the IRR, which is 18.46 percent for Project S. Notice also that at any cost of capital (WACC) less than the IRR of 18.46 percent, NPVₕ is greater than zero, so if WACC is less than 18.46 percent, then NPVₕ and IRRₕ both indicate that S should be accepted. Conversely, if the WACC is greater than 18.46 percent, then the NPV and IRR methods both indicate rejection. Therefore, in a situation where we are dealing with only one project, the NPV and IRR methods can never conflict—if one method indicates acceptance, then so will the other method.⁸

Now assume that Projects S and L are mutually exclusive. They both have a cost of $1,000, and both produce cash flows for four years. However, S’s inflows come primarily in the early years, giving it a relatively short payback, while L’s inflows come later, giving it a longer payback. The two projects are equally risky, and a WACC of 10 percent is assigned to them. At the 10 percent WACC, NPVₕ = $144.12 and NPVₕ = $118.64, so based on the NPV criterion, L should be selected. However, as we can see from the data and from Panel B, S has the higher IRR, 18.46 percent versus 14.84 percent for Project L. Therefore, a conflict exists between the two methods: The NPV method says choose L, while the IRR method says choose S. Notice also in Panel B that there would be no conflict between the methods if the WACC were greater than the crossover rate of 11.56 percent, because at that WACC, Project S would dominate in the sense that NPVₕ would be greater than NPVₕ and IRRₕ would exceed IRRₕ.⁹

We see from Panel B of Figure 11-1 that the NPVs of both projects decline as the cost of capital increases. At low costs of capital, Project L has the higher NPV, but its NPV profile line declines more rapidly than that of S, and at a WACC of 11.56 percent the NPV profiles cross. Project L’s NPV declines more rapidly as the WACC increases because most of its cash flows occur late in its life, and those distant cash flows are exponentially affected by a higher cost of capital. Most of S’s cash flows come in early, so its cash flows are not hurt as badly by high WACCs. The situation here is like that with bonds, where we saw long-term bonds’ prices decline more than those of short-term bonds when interest rates rise. The NPV profile lines are analogous to the bond interest rate sensitivity curves we discussed in Chapter 8.

Logic suggests that NPV is a better decision criterion than IRR because NPV selects the project that adds the most to shareholder wealth. Therefore, this method should generally be given the most weight in capital budgeting decisions. However, the IRR is still useful because decision makers like to know what rate of return they can expect on different investments.¹⁰

⁸This statement is always true for normal projects. Nonnormal projects, with more than one change in the sign of the cash flows, can have more than one IRR and thus can have conflicts between NPV and IRR.

⁹The crossover rate, where two NPV profiles intersect, is calculated in the Excel chapter model, and it is discussed more fully in Brigham and Daves, Intermediate Financial Management.

¹⁰We do sometimes find situations where one project’s NPV is larger than that of another, but the project with the smaller NPV has an IRR that is so much higher that it is reasonable to accept the one with the higher IRR. IRR advocates illustrate this point with an extreme situation: “Suppose one project has a cost of $100,000, a 30 percent IRR, and an NPV of $1 million, while another has a cost of $10 million, an IRR of 15 percent, and an NPV of $1.01 million. Which is the better project?” Most people would choose the small project in spite of its slightly lower NPV because so much less money is being put at risk. To deal with such situations, a method called the “profitability index,” which gives return per dollar invested, may be advocated.
Notes:
1. In Panel A, we see that if WACC \( \leq \) IRR, then NPV \( \geq 0 \), and vice versa.
2. Thus, for “normal and independent” projects, there can be no conflict between NPV and IRR rankings.
3. However, if we have mutually exclusive projects, conflicts can occur. In Panel B, we see that IRR\(_S\) is always greater than IRR\(_L\), but if WACC \( < 11.56\% \), then NPVL > NPVS, in which case a conflict occurs.
4. Summary: (a) For normal, independent projects, conflicts can never occur, so either method can be used. (b) For mutually exclusive projects, if WACC > Crossover, there is no conflict, but if WACC < Crossover, then there will be a conflict between NPV and IRR.

**Conclusions on Capital Budgeting Methods**

We have discussed the three most frequently used capital budgeting decision methods and highlighted their relative strengths and weaknesses. In making accept/reject decisions, sophisticated firms calculate and consider all available measures because each provides a different piece of relevant information.

Payback provides an indication of a project’s liquidity and risk—a long payback means (1) that the investment dollars will be locked up for many years, hence the project is relatively illiquid, and (2) that the project’s cash flows must be forecasted far out into the future, hence the project is probably risky. NPV is important because it gives a direct estimate of the project’s profitability by showing how much it is expected to add to shareholder wealth. IRR also measures profitability, but it is expressed as a percentage rate of return, which many decision makers prefer. If conflicts exist between the NPV and IRR methods, then more weight should be given to NPV because it shows how much wealth a project adds, and that is the ultimate test of a project’s value.

Each method provides a different piece of information to decision makers. Because it is easy to calculate all of them, they should all be considered in the decision process.
We recommend that the most weight should be given to NPV, but it would be foolish to ignore the information the other methods provide. It should also be noted that sophisticated managers do not make important decisions based solely on the results of quantitative measures such as NPV. Qualitative factors such as the chances of a tax increase, a military conflict, or a major product liability suit should also be considered. In summary, informed capital budgeting decisions should be the product of sound managerial judgment that reflects such quantitative measures as NPV and IRR, along with judgmental, qualitative factors that simply cannot be quantified.

**Self-Test Questions**

Define the three capital budgeting decision methods discussed in this section, and explain the rationale for each.

What information does the payback provide that is not provided by NPV and IRR? What information is provided by NPV? IRR?

Describe how NPV profiles are constructed. What information do they provide?

In general, should more weight be given to the NPV or to the IRR if those two methods produce conflicting results? Explain.

Should capital budgeting decisions be based solely on whether or not the NPV is positive and/or the IRR exceeds the WACC? Explain.

**Estimating Cash Flows**

The most important, and also the most difficult, step in capital budgeting is estimating the cash flows—the investment outlays and the annual cash inflows after a project goes into operation. Many variables are involved, and many individuals and departments participate in the process. For example, the forecasts of unit sales and sales prices are normally made by the marketing group, based on their knowledge of basic product demand, price elasticity, advertising effects, the state of the economy, competitors’ reactions, and consumer trends. Similarly, the capital outlays associated with a new product are generally obtained from engineering and product development experts, personnel specialists, purchasing agents, and so forth.

It is difficult to forecast the costs and revenues associated with a large, complex project, so forecast errors can be quite large. For example, when several major oil companies decided to build the Alaska Pipeline, the original cost estimates were in the neighborhood of $700 million, but the actual cost was closer to $7 billion. Similar (or even worse) miscalculations are common in forecasts of product design costs, such as the costs to develop a new aircraft such as Boeing’s 7E7. Further, as difficult as plant and equipment costs are to estimate, sales revenues and operating costs over the project’s life are even more uncertain. Just ask Polaroid, which recently filed for bankruptcy, or stockholders of now-defunct dot-com companies.

International projects are even more difficult to analyze than domestic ones for at least three different reasons:

1. The quality of data available in many countries is poor, and forecasts are subject to significant errors.
2. Exchange rates are often hard to forecast, and they rely on questionable assumptions such as purchasing power and interest rate parity that we discussed in Chapter 3.
3. Many of the costs associated with foreign projects are subject to political negotiations with host governments instead of being determined in the marketplace, and government officials can change their minds.

Such complexities often introduce a great deal of uncertainty into the forecasting process, and some of the required inputs may be little more than educated guesses.
A good forecast includes these steps: (1) Obtaining information from various departments such as engineering and marketing, (2) ensuring that everyone involved with the forecast uses a consistent set of economic and political assumptions, and (3) ensuring that no biases exist in the forecast. This last point is extremely important, because some managers become emotionally involved with pet projects or else seek to build empires. Both problems lead to cash flow forecasting biases that make bad projects look good, but only on paper.

It is almost impossible to overstate the problems one can encounter in cash flow forecasts. It is also difficult to overstate the importance of these forecasts. Still, observing the principles discussed in the next several sections will help minimize forecasting errors.

**Self-Test Questions**

What is the most important step in a capital budgeting analysis?
What departments are involved in estimating a project's cash flows?
Why are international projects more difficult to analyze than domestic projects?
What steps does a proper forecast analysis include?

**Identifying the Relevant Cash Flows**

The first step in estimating cash flows for use in a capital budgeting analysis is to identify the relevant cash flows, defined as the specific set of cash flows that should be considered in the current decision. Analysts often misestimate cash flows, but two cardinal rules can help you minimize mistakes: (1) Capital budgeting decisions must be based on cash flows, not accounting income. (2) Only incremental cash flows, caused by accepting the project, are relevant.

Remember from Chapter 6 that free cash flow is the cash flow available for distribution to investors. In a nutshell, the relevant cash flow for a project is the additional free cash flow that the company expects to realize if it accepts a project. It is the cash flow above and beyond what the company could expect if it does not implement the project. The following sections discuss the relevant cash flows in more detail.

**Project Cash Flow versus Accounting Income**

Recall from Chapter 6 that free cash flow is calculated as follows:

\[
\text{Free cash flow} = \frac{\text{Net operating profit after taxes}}{\text{(NOPAT)}} - \frac{\text{Net fixed asset expenditures}}{\text{Change in net operating working capital}}.
\]  

Just as a firm’s value depends on its free cash flows, so does the value of its proposed projects. We illustrate cash flow estimation later in the chapter with a comprehensive example, but it is important to understand how project cash flow differs from accounting income.

**Cash Flows Associated with Fixed Assets** Most projects require an investment in assets, and asset purchases require cash. Note too that substantial shipping and installation costs are often required, and those costs must be included along with the purchase price of the assets themselves. Finally, the fixed assets associated with a project can often be sold for cash at the conclusion of the project’s life, and the cash invested in the project’s working capital can also be recovered. We must consider these factors when we calculate projects’ net cash flows.
**Noncash Charges** Accountants do not subtract the cash purchase price of fixed assets when calculating accounting income, but they do subtract a noncash charge each year for depreciation.\(^{11}\) We handle things differently in capital budgeting—we show the project’s cost as an outflow in the year or years when those costs are incurred, and we add the annual depreciation charge back to net income when calculating annual cash flows. Since accountants take depreciation out when they calculate net income, we must add it back in when we find the annual cash inflows (i.e., Cash flow = Net income + Annual depreciation).\(^{12}\)

**Change in Net Operating Working Capital** The net operating working capital associated with a new project is calculated as follows:\(^{13}\)

\[
\text{(Required change in net operating working capital)} = \left(\text{Required additions to inventory}\right) + \left(\text{Increase in accounts receivable}\right) - \left(\text{Increase in accounts payable and accruals}\right).
\]

The investment in net new operating working capital requires capital, and like the investment in fixed assets, it represents a negative cash outlay. Note that projects that simply reduce costs, like replacing inefficient machinery with newer and more efficient machines, generally do not require additional working capital and may in fact even reduce it. However, expansion projects generally require additional working capital. Investors must provide this capital, and they expect to earn a return on it. Note too that during the project’s later years, or at the end of its life, annual sales will decline, and when that occurs, inventories will be sold off and receivables will be collected. Thus, the funds initially invested in net operating working capital will eventually be recovered, and that amounts to a cash inflow in the recovery year.\(^{14}\)

**Interest Expenses Are Not Included in Project’s Cash Flows** Recall that we discount a project’s free cash flows by its cost of capital, and the cost of capital is a risk-adjusted weighted average, the WACC, which is the rate of return necessary to satisfy all the firm’s investors. A bad mistake is to subtract interest payments when estimating a project’s cash flows. Because the cost of debt is included in the WACC, which is then used to discount the cash flows, subtracting interest payments from the project’s cash flows would result in double counting interest expenses.\(^{15}\)

Note that our treatment of interest differs from the procedures used to calculate accounting income. Accountants measure the profits available for stockholders, and for that purpose interest expenses must be subtracted. However, in capital budgeting we are interested in the cash flows available to all investors, creditors as well as shareholders, so interest expenses are not subtracted. This is analogous to the procedures used in the corporate valuation model discussed in Chapter 9, where the company’s free cash flows were discounted at the WACC. Therefore, you must **not subtract interest expenses when finding a project’s cash flows**.

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\(^{11}\)Depreciation does shelter income from taxation, and that increases cash flow, but depreciation itself is not a cash flow.

\(^{12}\)If any other noncash charges had been deducted when determining the expected net income, we would also have to add them back, but generally depreciation is the only noncash charge of concern.

\(^{13}\)If additional cash or any other type of current asset was required as a result of the investment, it too would be shown as part of the investment in net operating working capital.

\(^{14}\)The return of the investment in working capital is not generally subject to taxes.

\(^{15}\)If someone subtracted interest (or interest plus principal payments) from the project’s cash flows, then they would be calculating the cash flows available to the equity holders, and these cash flows should be discounted at the cost of equity. This technique can give the correct answer, but in order for it to work you must be very careful to adjust the amount of debt outstanding each year to keep the riskiness of the equity cash flows constant. This process is very complicated, and we do not recommend it.
Incremental Cash Flows

In a project analysis, we focus on those cash flows that occur if and only if we accept the project. These cash flows, called incremental cash flows, represent the change in the firm's total cash flows that occurs as a direct result of accepting the project. Three special issues in finding incremental cash flows are discussed next.

Sunk Costs A sunk cost is an outlay that has already occurred and hence is not affected by the decision under consideration. Since sunk costs are not incremental costs, they should not be included in the analysis. To illustrate, in 2005, Northeast BankCorp was considering whether to establish a branch office in a newly developed section of Boston. To help with its evaluation, Northeast had, back in 2004, hired a consulting firm to perform a site analysis; the cost was $100,000, and this amount was expensed for tax purposes in 2004. Is this 2004 expenditure a relevant cost with respect to the 2005 capital budgeting decision? The answer is no—the $100,000 is a sunk cost, and it will not affect Northeast's future cash flows regardless of whether or not the new branch is built. It often turns out that a particular project has a negative NPV if all the associated costs, including sunk costs, are considered. However, on an incremental basis, the project may be a good one because the future incremental cash flows are large enough to produce a positive NPV on the incremental investment. That is, they more than cover their future cost and generate at least some revenue to help cover the sunk costs.  

Opportunity Costs A second potential problem relates to opportunity costs, which are cash flows that could be generated from an asset the firm already owns if it is not used for the project in question. To illustrate, Northeast BankCorp already owns a piece of land that is suitable for a branch location. When evaluating the prospective branch, should the cost of the land be disregarded because no additional cash outlay would be required? The answer is no, because there is an opportunity cost inherent in the use of the property. For example, suppose the land could be sold for $150,000 after taxes. Use of the site for the branch would require forgoing this inflow, so the $150,000 must be charged as an opportunity cost against the project. Note that the proper land cost in the example is the $150,000 market-determined value, regardless of whether Northeast originally paid $50,000 or $500,000 for the property. (What Northeast paid would, of course, have an effect on taxes, hence on the after-tax opportunity cost.)

Effects on Other Parts of the Firm: Externalities The third potential problem involves the effects of a project on other parts of the firm, which economists call externalities. For example, some of Northeast's customers who would use the new branch are already banking with Northeast's downtown office. The loans and deposits, hence profits, generated by these customers would not be new to the bank; rather, they would simply be transferring from the main office to the branch. Thus, the net income produced by these customers should not be treated as incremental income in the capital budgeting decision. On the other hand, having a suburban branch would help the bank attract new business to its downtown office because some people would like to be able to bank both close to home and close to work. In this case, the additional income that would actually flow to the downtown office should be attributed to the branch. Although they are often difficult to quantify, externalities (either positive or negative) should be considered.

An additional note: Managers who want to bias the analysis in favor of some pet project have been known to make significant expenditures that will benefit the project prior to conducting the formal analysis. These costs, then, are sunk, so there is an upward bias in the analysis—the "true" NPV is negative, but the NPV of the incremental cash flows is positive. Managers who deliberately bias projects ought to be fired!
When a new project takes sales from an existing product, this is an externality called cannibalization. Cannibalization occurs when a firm builds a plant abroad and substitutes foreign production for parent company exports. To the extent that the new project takes sales from existing corporate units, the new project’s estimated profits should be reduced by the earnings lost on existing sales. Naturally, firms do not like to cannibalize existing products, but it often turns out that if they do not, someone else will. To illustrate, IBM for years refused to provide full support for its PC division because it did not want to steal sales from its highly profitable mainframe business. That turned out to be a huge strategic error, because it allowed Intel, Microsoft, Dell, and others to become dominant forces in the computer industry. Therefore, when contemplating externalities, the long-run implications of the proposed new project should be included in the analysis.

**Timing of Cash Flows**

We must account properly for the timing of cash flows. Accounting income statements are for periods such as years or months, so they do not reflect exactly when during the period cash revenues or expenses actually occur. Because of the time value of money, capital budgeting cash flows should, in theory, be analyzed exactly as they occur. Of course, there must be a compromise between accuracy and feasibility. A time line with daily cash flows would in theory be most accurate, but daily cash flow estimates would be costly to construct, unwieldy to use, and probably no more accurate than annual cash flow estimates because we simply cannot forecast well enough to warrant this degree of detail. Therefore, in most cases, we simply use three rules of thumb when assigning cash flows to time periods: (1) We assume that capital expenditures occur at the beginning of periods; (2) we assume that capital inflows (return of capital) occur at the end of periods; and (3) we assume that operating cash flows, both revenues and expenses, are netted out and reported at the end of the period in which they were generated. These are very conservative assumptions, so projects that pass the NPV hurdle with them in place are almost certain to pass under more favorable assumptions. However, for projects with highly predictable cash flows, it might be best to assume that cash flows occur at mid-year, or even quarterly or monthly, to avoid imparting a downward bias to the NPV.

**Self-Test Questions**

Why should companies use project cash flows rather than accounting income when calculating a project's NPV?

What is the most common noncash charge that must be added back when finding project cash flows? Why is it added back?

What is net operating working capital, and how does it affect a project's cash flows?

Explain the following terms: relevant cash flow, incremental cash flow, sunk cost, opportunity cost, externalities, and cannibalization.

Explain why in most capital budgeting analyses we simply assume that all cash flows occur at the end of every year.

**Adjusting for Inflation**

Inflation is a fact of life all over the world, so it must be considered in any sound capital budgeting analysis; failure to do so can corrupt the analysis.\(^{17}\)

for differences in inflation rates across countries is also important because it can change a firm’s competitive position, especially when exchange rate changes are slow to adjust to differences in inflation rates.

In capital budgeting analysis, some analysts mistakenly use base-year, or constant (unadjusted), dollars throughout the analysis—say, 2005 dollars if the analysis is done in 2005—along with a cost of capital as determined in the marketplace as we described in Chapter 10. This is wrong: If the component costs of capital include an inflation premium, as they typically do, but the cash flows are all stated in constant purchasing power (unadjusted) dollars, then the calculated NPV will be lower than the true NPV. The denominator will be high because it reflects inflation, but the numerator will not have an upward adjustment, and this will produce a downward-biased NPV.

The most common method for inflation adjustment involves leaving the cost of capital in its nominal form and then adjusting the individual cash flows, both revenues and expenses, to reflect expected inflation. For example, we might assume that sales prices and variable costs will increase by 2 percent per year, that fixed costs will increase by 1 percent per year, and that depreciation charges (since they are based on historical costs) will be unaffected by inflation. In general, we should always build inflation into the cash flow analysis, with the specific adjustments reflecting as accurately as possible the most likely set of circumstances. With a spreadsheet, it is easy to make these adjustments. For companies that operate in high inflation environments or in circumstances where inflation is highly variable, it is often useful to analyze projects in both nominal and real (constant currency) terms.18

**Self-Test Questions**

Explain why inflation should be considered in a capital budgeting analysis. What is the most common way of handling inflation, and how does this procedure eliminate a potential bias?

**Evaluating Foreign Projects**

Multinational enterprises with projects in foreign countries can use the analytical methods described above in the same way as purely domestic companies. However, they face challenges that are not usually encountered in a single-country analysis that significantly affect cash flows and discount rates. First, cash flows are often generated in foreign currencies, and they are subject to different accounting and tax treatments than in the home country. Because exchange rates often fluctuate over time, the dollar-equivalent amounts are even less certain than the original foreign currency cash flows. Second, some countries either place restrictions on the amount of money that can be repatriated from the local subsidiary to the parent or impose taxes on funds sent abroad. In the extreme, countries may prohibit the repatriation of capital or earnings to the parent until the subsidiary is liquidated or sold to local investors. Third, MNEs face unique risks when they operate abroad. For instance, the host government may change the conditions for repatriating funds, or adopt confiscatory tax policies, or even expropriate local operations.

18Although the nominal and real approaches should yield roughly similar answers if done properly, consulting firms such as McKinsey and Company argue that the two approaches provide some additional insights and also reveal potential shortcomings in the analysis. See, for instance, Tom Copeland, Tim Koller, and Jack Murrin, Valuation: Measuring and Managing the Value of Companies (New York: John Wiley and Sons Inc., 2000).
Adjust for Risk in the Discount Rate or the Cash Flows?

The additional risks of foreign investments need to be incorporated into the valuation equation, and the adjustment can be made to either the cash flows in the numerator or the discount rate in the denominator. Traditionally, risk is incorporated into the analysis by increasing the risk premium embedded in the discount rate. However, a second alternative, which is conceptually superior if it can be implemented, is to make the risk adjustment by lowering the cash flows and then discounting at the domestic cost of capital. For instance, future cash flows in foreign currency can be estimated using forward rates that eliminate unexpected changes in exchange rates. Risks associated with nonconvertibility and expropriation, as well as political violence to business income and assets in place, can be eliminated through insurance issued by organizations such as the Overseas Private Investment Corporation (OPIC). If insurance is used, the premium is subtracted from the cash flows themselves, and the remaining cash flows are discounted at the domestic cost of capital. Note, though, that insurance is not feasible for all foreign investments, and other adjustments to the cash flows are often nothing more than informed guesses.

Compartmentalizing Risks Using Alternative Perspectives

A second procedure that companies use to deal with risk is to compartmentalize risks by using three separate types of analysis. First, the firm conducts a financial analysis of the project in the traditional manner, but strictly from the perspective of the local subsidiary. This analysis is exactly like one that would be done for the project by a local company in the host country, and it is called a project perspective analysis. If the project does not have a positive NPV in this evaluation, this probably means that our company does not have a competitive advantage over local companies in this line of business. Projects should generally have a positive NPV to warrant further consideration.

Assuming that the project passes the first screen, many companies then recalculate the NPV—focusing not on the operating cash flows of the project itself but on the capital transfers from the parent to the subsidiary and the cash flows from the project that can be repatriated back to the parent. These cash flows are very different from the ones developed for the project perspective, and they usually include both operating and financial components. Thus this analysis, called the parent perspective analysis, mixes the investment and financing decisions, which is usually a questionable procedure. Still, the parent perspective is important for investments in some countries where there is a high likelihood that cash flows will be blocked from redistribution elsewhere in the MNE, including the servicing of debt and payment of dividends. In this case, the traditional NPV overstates the value of the project to the parent firm. Daewoo learned this lesson the hard way when it encountered severe financial difficulties but was unable to use the cash flows from its subsidiary in Uzbekistan to help relieve its problems.

A third screen, called the country perspective analysis, is beginning to be used by MNEs to gauge the long-run potential of the project. This evaluation, which often employs subjective factors that are hard to quantify, looks at the project’s contribution to the host nation and the local stakeholders who will be most affected. The underlying rationale here is that if the project does not make a positive contribution

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19As we saw in Chapter 3, forward swap rates go out at least to five years and can be used for this purpose.
to the country and local stakeholders, there may well be tension between the com-
pany and the government, possibly leading to harassment and even confiscation.
Governments do change, and harsh measures might well be imposed if a new
nationalist government replaced the officials now in power. So, projects are less
risky if the host country as well as the company itself benefits.

Identify three major challenges companies face when implementing
foreign projects.
What are the three perspectives from which projects may be evaluated?

EVALUATING CAPITAL BUDGETING
PROJECTS: AN EXAMPLE

We illustrate capital budgeting analysis by examining an investment being consid-
ered by Sound Systems International (SSI), a California-based multinational manu-
facturer of sound systems. The company currently has subsidiaries in Mexico,
Argentina, and Germany, but sales in Asia are forecasted to expand rapidly. The
Asian market is now being served by SSI Germany, but, because of high transporta-
tion costs, the profit margin is only 5 percent. Several of the company’s directors
have been pushing the creation of a subsidiary in Shanghai to serve the growing
Asian market. This group points out that Chinese labor costs are low, transpor-
tation systems are well developed, and thus that it would be comparatively inexpen-
sive to serve SSI’s Asian markets from Shanghai. The Business Development Team
(BDT) from SSI’s headquarters in California has been negotiating with Chinese officials
for almost two years to find mutually acceptable requirements for establishing
a subsidiary in the Pu Dong Special Economic Area of Shanghai, and the two sides
are now close to agreement. The BDT has negotiated the terms under which the
investment would be made, and SSI must now undertake a formal analysis of the
project to decide if it would be profitable.

The Chinese Investment Project

We first evaluate the Shanghai operation from a project perspective. If it passes that
hurdle, then it is examined from the perspective of SSI-USA, the parent, to see if the
cash flows that can be returned are sufficient to cover the original investment.
Finally, we consider the country perspective to see how China would benefit from
the project.

We use an Excel model to analyze the project, finding its cash flows and then the
NPV, IRR, and payback. Selected portions of the model are printed out and shown
as tables throughout this section.

Required Investment SSI has located a building with a secure storage area in
the Pu Dong industrial zone. The site has the utilities required for production, and
it has easy access to transportation connections that serve both the domestic mar-
ket, by rail and by barge up the Yangtze River, and export sales through the port of
Shanghai. The building’s cost is $7.5 million, payable in dollars but recorded on the
books of the subsidiary as CNY 62.1 million at the spot exchange rate of CNY
8.28/$. The money to purchase the building will come from SSI-USA as a $10 mil-
lion equity infusion. An additional equity contribution from SSI will come from
both standard and specialized production equipment developed and patented by SSI
worth $5 million or CNY 41.4 million. Thus, the equity contribution will be $15
million: $10 million in cash and $5 million in assets. Chinese import regulations
require that equipment acquired from other countries must use the latest technology before an import license will be granted, and misrepresentations of the technology subject the company to a hefty penalty, but SSI has obtained approval for the equipment it intends to send. The remainder of the cash supplied by SSI will be used to acquire additional standard production equipment in China for a total cost of CNY 20.7 million, or $2.50 million. This acquisition brings the total investment in equipment to CNY 62.1 million.

China requires companies to use straight-line depreciation unless special permission is given to use accelerated methods. SSI has not been able to secure such permission, so all fixed assets will be depreciated using straight-line depreciation, but for differing periods. Chinese tax regulations classify buildings as 20-year assets, mechanical production equipment as 10-year assets, and specialized electronics production equipment as 5-year assets. Thus, the cost, depreciable life, and annual depreciation will be as follows:

<table>
<thead>
<tr>
<th>Asset</th>
<th>Cost</th>
<th>Depreciable Life</th>
<th>Annual Depreciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building</td>
<td>CNY 62.10 million</td>
<td>20</td>
<td>CNY 3.105 million</td>
</tr>
<tr>
<td>Mechanical equipment</td>
<td>CNY 31.05 million</td>
<td>10</td>
<td>CNY 3.105 million</td>
</tr>
<tr>
<td>Electronic equipment</td>
<td>CNY 31.05 million</td>
<td>5</td>
<td>CNY 6.210 million</td>
</tr>
</tbody>
</table>

Working capital will also be needed by the operation. The best estimate of required net operating working capital is CNY 41.4 million. As production and sales increase, net operating working capital is expected to increase by CNY 2 million per year. The initial working capital will be obtained by a yuan-denominated loan of CNY 41.4 million for five years at a borrowing rate of 6 percent.

**STUDY PERIOD** The subsidiary is expected to operate indefinitely. SSI has a policy of investing in a country for the long run and will not make the first investment if it does not believe that the long-run potential is positive. However, for project analysis, the company always uses a five-year study period. When the project’s economic life is longer than five years, as it is in this investment, the company estimates the project's salvage value as of the end of Year 5 and adds it to the cash flows.

**PROJECTED SALVAGE VALUES** SSI uses two methods for estimating salvage values at the end of the study period. First, it estimates the market value of the fixed assets, adjusted for taxes, and adds the value of recovered net operating working capital. This is a liquidating value concept. Table 11-1 shows the after-tax salvage values (according to the liquidating-value concept) for the project's building and equipment at the end of the study period.

The second method for estimating a salvage value takes the net operating cash flow in Year 5, NOCF₅, estimates the growth rate in NOCF for the future, and uses the terminal value formula,

\[ SV₅ = \text{NOCF}_5(1 + g)/(\text{WACC} - g), \]

Note that if an asset is sold for exactly its book value, there will be no gain or loss, hence no tax liability or credit. However, if an asset is sold for other than its book value, a gain or loss will be created. For example, SSI’s building will have a book value of CNY 46,575,000, but the company expects to realize CNY 58,218,750 when it is sold. This would result in a gain of CNY 11,643,750. This indicates that the building should have been depreciated at a higher rate—if depreciation had been CNY 11,643,750 more, the book and market values would have been equal. So, the U.S. Tax Code stipulates that gains on the sale of operating assets indicate that the depreciation rates were too low, so the gain is called “depreciation recapture” by the U.S. Internal Revenue Service and is taxed as ordinary income. On the other hand, if an asset is sold for less than its book value, then the difference can be used to reduce ordinary income, just as depreciation reduces income. The tax rules are essentially the same in other countries.
to estimate the Year 5 value of the future cash flow. This procedure is a going concern concept and is appropriate if the project will continue beyond the study period. Note that if the project is treated as a “going concern,” the salvage value is not actually recovered in Year 5. It is added to the Year 5 total cash flows to represent the value of the continuing operations as of that point in time. Generally SSI computes the salvage value using both methods and uses the lower estimate in its project analysis as a conservative estimate. If the going concern value is significantly greater than the liquidating value, though, this fact is included as part of the decision information.

**Exchange Rates** The exchange rate for the Chinese yuan has been stable at CNY 8.28 per dollar since 1998, and the government has announced that it foresees no change in the rate for at least the next five years. In 2003, the IMF reported that it did not believe the yuan to be undervalued, but private economists assert that it is undervalued by some 10 to 15 percent. Even so, forward quotations going out as far as five years indicate that the market expects the rate to be steady at CNY 8.28 to the dollar. Note that the actual rate is not determined in the market but is set by the government based on mainly political considerations, although not entirely divorced from the underlying economics. In this analysis, to serve as the base case, we will assume that the exchange rate will be constant at CNY 8.28/$ for the next five years. In Chapter 12, we explore the implications for the project of a revaluation of the yuan.

**Cash Flows to the Parent** China has a reputation as a country from which it is sometimes challenging to repatriate funds or to acquire foreign inputs to the production process because of rather stringent foreign exchange and capital controls. In general, capital must remain in China as long as the company continues operations, and companies can acquire foreign exchange to use in repatriating operating funds or paying for imports only up to the amount of foreign exchange the company earns on its export sales. SSI believes that the level of exports will be more than enough to satisfy this requirement, but they are worried about other restric-
tions the government might decide to place on repatriating funds. Thus, they would like to have the flexibility to move funds back to California as quickly and in as large an amount as possible. The Chinese government has agreed to allow three sources of cash flow to be sent to the parent annually:

1. License fees—equal to 2 percent of gross sales.
2. Management fees—equal to a fixed CNY 1.656 million plus 0.5 percent of gross sales.
3. Dividends after required reinvestment.

None of these transfers are subject to withholding taxes, but, as pointed out earlier, SSI must generate sufficient foreign exchange from export sales to cover the payments. If they do not do so, the payments are blocked. Also, it is conceivable that in the future China might impose withholding taxes on the company, but the team considers it unlikely in the next 5 years because of the agreement with the government.

**GENERAL COMPANY DATA** The marginal tax rate in China is 40 percent, comprised of a 30 percent national rate plus a 10 percent local rate. However, new investments receive concessionary treatment so that in the first year profits are earned, the tax rate is zero. Then, in Years 2 and 3, the tax rate is one-half of the normal rate, or 20 percent. Thereafter the full 40 percent rate applies. In the United States, a federal-plus-state tax rate of 40 percent applies for all years.

**FIRST-YEAR PROJECTIONS** The marketing department has made a series of forecasts of expected unit sales, sales growth, and sales price. While local and export unit sales are expected to grow, the sales prices are expected to be stable. The domestic price in China, though, will have to be lower because of the lower purchasing power in the country. This lower price is justified in terms of cheaper transportation and distribution costs. The department has also put together cost and inflation estimates for the project’s expenses. All of these estimates can be seen in Table 11-2.

**CANNIBALISM** The export sales in China will come at the expense of German sales to those export markets. The local sales in China are new sales, as Germany currently sells almost nothing in China. The computation of the erosion is as follows:

\[
\text{Erosion opportunity cost} = \frac{\text{Export sales revenue}}{\text{Profit margin in Germany}} \times \text{Profit margin in Germany}.
\]

There is a controversy, though, about whether the erosion figures should be included in the analysis. Some of the analysts point out that the German capacity will not remain idle but will be used to penetrate other markets in Europe and the former Soviet Union that are not being served to the fullest extent. These analysts suggest that the only reason the capacity to serve these new markets exists is because of the Chinese expansion, so the extra sales should also be attributed to China. Alternatively, the erosion calculations could be eliminated from the evaluation of the Shanghai facility. However, at least in the initial stage of the analysis, SSI will take a conservative approach and consider the lost German sales as an externality, while ignoring possible new German sales.

**Project Perspective Analysis**

The project perspective looks at the economic feasibility of investing in the Shanghai production unit from the point of view of a local Chinese company considering the investment. When evaluating a potential project from this perspective, the starting
The point is to estimate the expected cash flows, which typically include the following items:

1. **Required investment.** This includes the cost of the fixed assets associated with the project plus any investment in net operating working capital (NOWC), such as raw materials, accounts receivable, or cash. Many projects have levels of NOWC that change during the project’s life. For example, if sales increase, more NOWC will be required, and if sales fall, less NOWC will be needed.

2. **Annual project operating cash flow.** The operating cash flow is the net operating profit after taxes (NOPAT) plus depreciation. Recall (a) that depreciation is added back because it is a noncash expense and (b) that financing costs (including interest expenses) are not subtracted out because they are incorporated in the firm’s cost of capital used to discount the project’s cash flows.

3. **Terminal year cash flow.** At the end of the project’s life, or at the end of the study period if the project is to continue, some extra capital cash flow is usually generated from the salvage value of the fixed assets, adjusted for taxes if the assets are not sold at their book value. Any return of net operating working capital not already included in the annual cash flow must also be added to the terminal year capital cash flow.

The classification of cash flows is not always as distinct as we have indicated here. For example, in some projects the acquisition of fixed assets is phased in throughout the project’s life, and for other projects, some fixed assets are sold off at times other than the project’s terminal year. The important point to remember is to include all required investment cash flows in your analysis using the rules mentioned earlier to get the timing right, no matter how you classify them or when they occur.

### Table 11-2: Input Data for SSI’s Shanghai Project

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT DATA (all yuan and dollars in thousands)</td>
<td>1ST YEAR PROJECTIONS &amp; GROWTH RATES</td>
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<tr>
<td><strong>Investment &amp; Financing</strong></td>
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<tr>
<td>Cash</td>
<td>USD 15,000</td>
<td>Unit sales</td>
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<td>Manufacturing equipment</td>
<td>USD 5,000</td>
<td>Expected growth</td>
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<td>Subsidiary investment</td>
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<tr>
<td>Locally borrowed funds (NOWC)</td>
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<td>Export sales</td>
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<td>Local borrowing rate</td>
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<td><strong>Required Asset Investment</strong></td>
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<td>Direct Materials (per unit)</td>
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<td>Electronic equipment</td>
<td>CNY 21,591</td>
<td>Expected growth</td>
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<td>Annual increase in NOWC</td>
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<td><strong>Project Life</strong></td>
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<td>Project life</td>
<td>5y</td>
<td>General and administrative expenses</td>
<td>CNY 199,000</td>
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<td><strong>General Company Data</strong></td>
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<td>Chinese marginal tax rate</td>
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<td>License fee of sales</td>
<td>2.0%</td>
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<tr>
<td>Tax rate on Year 1 profits</td>
<td>0.0%</td>
<td>Management fee [fixed]</td>
<td>USD 209</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax rate on Year 2 and 3 profits</td>
<td>10.0%</td>
<td>Management fees (% of sales)</td>
<td>0.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax rate, themselves</td>
<td>30.0%</td>
<td>Profit after tax</td>
<td>2.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US marginal tax rate</td>
<td>40.0%</td>
<td>Profit before tax</td>
<td>21.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic WACC</td>
<td>8.70%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk-adjusted foreign WACC</td>
<td>11.75%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange rate (CNY/USD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Currency in Thousands**
For each year of the project’s life, the *free cash flow* is the sum of the required investment and operating cash flows. These annual free cash flows are then placed on a time line and used to calculate the project’s NPV and IRR.

Multinational firms analyzing projects in foreign countries must consider the additional issue of fluctuating exchange rates when conducting the analysis from the project perspective. Consequently, in this situation, modifications to the domestic NPV analysis must be made. There are two main approaches for handling projects with cash flows that are denominated in foreign currencies:

1. Estimate the project’s cash flows in the foreign currency (e.g., Chinese yuan) and discount them at the appropriate Chinese-based discount rate to find the yuan-denominated NPV. Then, use the spot exchange rate (e.g., CNY/$ rate) to convert the yuan-denominated NPV to a dollar-denominated equivalent NPV. This is the methodology we will follow in our Shanghai project example.

2. Estimate the project’s cash flows in the foreign currency and use forward exchange rates, interest rate parity, purchasing power parity, or an alternative foreign exchange rate forecasting model to determine expected CNY/$ exchange rates that correspond to the time period for each of the cash flow estimates. After converting annual yuan cash flows to annual dollar cash flows, calculate the project’s expected dollar-denominated NPV using an appropriate U.S.-based discount rate. Because the Chinese government mandates a pegged value of the yuan versus the dollar, we will defer this analysis to the next chapter when we talk about the possibility of the exchange rate changing.

Surveys of discounted cash flow practices in an international setting indicate that financial practitioners and consultants use each of these approaches about equally.21 These two approaches will yield the same answer if the foreign exchange parity conditions covered in Chapter 3 hold perfectly. However, in practice, deviations from the parity conditions do occur.

**Calculating the Required Investment, Operating, and Total Cash Flows** We begin the project perspective analysis by developing the investment cash flows as shown on the top five rows of Table 11-3. The data are given in a timeline format corresponding to the five-year study period. Row 53 shows the purchase price of the building at time zero and the after-tax salvage value at Year 5. Rows 54 and 55 record similar entries for the two classes of machinery, while Row 56 shows the required net operating working capital. Notice that the initial working capital must be supplemented over time as production and sales increase. Then, in Year 5, the investment in working capital is recovered. Row 57 sums these data and thus shows the total required investment cash flows required for the Chinese project.

Note that all entries in Table 11-3 are denominated in yuan even though the building and much of the machinery were actually paid for with dollars. This is consistent with the philosophy of the project perspective in that we look at the investment from the point of view of local management in Shanghai and ask, “Would this investment add value if it were made by a local Chinese company that had the same opportunities as our subsidiary?” Also note that we assumed that the entire CNY 49.4 million investment in working capital would be recovered. If bad debts or inventory shrinkages occur, the recoverable working capital would be substituted in Year 5.

---

Now consider the project’s operating cash flows. Rows 60 and 61 represent annual local and export sales in units, and Rows 62 and 63 show units multiplied by the price per unit, or sales revenues. Annual expenses, based on the assumptions set earlier, come next, and total revenues minus total expenses yields before-tax operating income. Note that we did not include interest as an expense in the operating cash flows.

The tax calculation is in accordance with the Chinese investment incentives, where tax rates are reduced for the first three years of profitable operations. We then show net operating profit after taxes (NOPAT), and then we add back depreciation (because it is a noncash expense) to find the net after-tax cash flow. Row 77 represents a cash flow time line, and these are the numbers that would generally enter our analysis. Some members of the evaluation team believe these are the numbers that should be used to calculate the NPV, but the majority view is that the reduction in German export sales is an externality (cannibalization) that should be charged to this project. Therefore, we subtract the cannibalized costs on Row 78 to find the effective operating cash flows on Row 79.

### Table 11-3
SSI’s Shanghai Project, Cash Flow Analysis
(Currency in Thousands of Chinese Yuan)

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Time period</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>1. Req. investment CFs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Building</td>
<td>-65,100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Mechanical Machinery</td>
<td>-31,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Electrical Machinery</td>
<td>-11,111</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>NOWC</td>
<td>-4,100</td>
<td>-2,300</td>
<td>-2,000</td>
<td>-2,000</td>
<td>-2,000</td>
<td>43,400</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Req. investment CFs</td>
<td>-105,000</td>
<td>-2,300</td>
<td>-2,000</td>
<td>-2,000</td>
<td>-2,000</td>
<td>125,050</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>2. Operating cash flows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Local unit sales</td>
<td>20,505</td>
<td>23,100</td>
<td>22,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Export unit sales</td>
<td>30,000</td>
<td>32,400</td>
<td>34,600</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Local revenues</td>
<td>200,205</td>
<td>241,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Export revenues</td>
<td>422,250</td>
<td>456,262</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>64</td>
<td>Total revenues</td>
<td>672,055</td>
<td>706,262</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Direct Materials</td>
<td>-223,300</td>
<td>-275,400</td>
<td>-275,400</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Direct Labor</td>
<td>-180,500</td>
<td>-207,627</td>
<td>-237,400</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>G&amp;A</td>
<td>-1,713</td>
<td>-2,125</td>
<td>-2,437</td>
<td>-2,750</td>
<td>-3,063</td>
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</tr>
<tr>
<td>68</td>
<td>Insurance</td>
<td>-1,175</td>
<td>-1,175</td>
<td>-1,175</td>
<td>-1,175</td>
<td>-1,175</td>
<td></td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>License Fees</td>
<td>-12,445</td>
<td>-1,175</td>
<td>-1,175</td>
<td>-1,175</td>
<td>-1,175</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>Management Fees</td>
<td>-4,797</td>
<td>-4,797</td>
<td>-4,797</td>
<td>-4,797</td>
<td>-4,797</td>
<td></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>Depreciation</td>
<td>-12,422</td>
<td>-12,422</td>
<td>-12,422</td>
<td>-12,422</td>
<td>-12,422</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>Total expenses</td>
<td>-373,183</td>
<td>-417,515</td>
<td>-461,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>73</td>
<td>BT operating income</td>
<td>73,317</td>
<td>74,516</td>
<td>75,308</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>Less: Taxes</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>NOPAT</td>
<td>73,315</td>
<td>74,514</td>
<td>75,306</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>Add back: Depreciation</td>
<td>12,422</td>
<td>12,422</td>
<td>12,422</td>
<td>12,422</td>
<td>12,422</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>Net After-Tax Cash Flow</td>
<td>85,737</td>
<td>86,936</td>
<td>87,728</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>Less: Cannibalism</td>
<td>21,114</td>
<td>22,303</td>
<td>23,492</td>
<td>24,680</td>
<td>25,868</td>
<td></td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>Operating CFs</td>
<td>64,623</td>
<td>64,633</td>
<td>64,236</td>
<td>64,040</td>
<td>64,002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>3. TOTAL CFs</td>
<td>64,623</td>
<td>64,633</td>
<td>64,236</td>
<td>64,040</td>
<td>64,002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>4. Financial results</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>82</td>
<td>NPV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>IRR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>Payback</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The final step is to sum the required investment and operating cash flows to obtain the project’s total annual cash flows on Row 80. When these cash flows are discounted at the 11.75 percent WACC, an NPV of CNY 110,000, or approximately $13,000 (at the current spot rate of CNY 8.28/$) is obtained. We also calculate an IRR, which turns out to be 11.77 percent, barely greater than the 11.75 percent WACC. Note also that the payback is nearly as long as the five-year projected operating life, and the only reason the project pays back at all is due to the projected salvage value. However, note that if we omitted the cannibalization deduction as advocated by some SSI staff members, the NPV would increase to CNY 88.4 million or $10.7 million, more than enough to make the project pay back from the operations.

Note too that we have assumed that the project will be liquidated after Year 5, even though sales, profits, and cash flows are all projected to be growing nicely. Therefore, a good case could be made for using the going concern concept for estimating the project’s value at Year 5. From Table 11-3, the growth rate in the operating cash flow between Years 4 and 5 (when the full impact of the 40 percent tax rate is felt) is 4.52 percent. If we assume that the cash flow will grow indefinitely at this rate, we can use the formula developed in Chapter 9 to estimate the Year 5 value of the continuing stream of cash flows as follows:

\[
SV_5 = \frac{\text{NOCF}_5(1 + g)}{(WACC - g)}
\]

\[
= \frac{\text{CNY 22,265 million}(1.0452)}{(0.1175 - 0.0452)}
\]

\[
= \text{CNY 321.9 million, or $38.9 million.}
\]

This is considerably higher than the CNY 120.8 million liquidating value used for the salvage value in the base case, and it would make the project look much better at an NPV of CNY 115.3 million ($14.0 million). If we also ignored the cannibalization issue in calculating the going concern value, it would be even higher.

Our conclusions from the project perspective analysis are that the project is marginally acceptable, but it is quite risky—all of the cash flows are uncertain, and the factor that makes the NPV turn positive, the salvage value, is extremely difficult to estimate. We take some consolation from the fact that we used a very conservative liquidating value assumption in estimating the salvage value, but it is still worrisome.

**Parent Perspective Analysis**

The second analysis conducted by most MNEs recognizes that foreign investments that look good on a project-perspective basis may not really be worthwhile if their cash flows cannot be integrated into the corporate network. Thus, SSI wants to know whether cash generated by the Shanghai project can be reallotted to other operating units of the company or used to service debt or pay dividends. If the funds are blocked and cannot be removed from the host country, the investment will not be attractive in the short run, and perhaps not even in the long run. This analysis looks at the investment project from the parent’s perspective, focusing on the cash flows moving between the foreign subsidiary and the parent.

Table 11-4 illustrates the types of cash flows analysts use to calculate the NPV from the parent perspective. Notice that many of the intracorporate cash flows represent financial transactions. In our discussion of the project perspective, we emphasized that interest should not be included in the cash flows because we were concerned

---

22The continuing growth rate is assumed to be the growth rate in net operating cash flows between Years 4 and 5. Thus, 
\[ g = \frac{\text{NOCF}_5 - \text{NOCF}_4}{\text{NOCF}_4} = \frac{22,265,000 - 21,303,000}{21,303,000} = 0.0452, \text{ or } 4.52 \text{ percent.} \]

23Note that this formula assumes that the cash flows continue to grow forever. This is unrealistic, but if a shorter period such as 25 years is used, this does not change the result materially because the PV of the distant cash flows rapidly approach zero unless the growth rate is high relative to the WACC used as the discount rate.
only with operating cash flows, with financial effects being reflected in the WACC. However, in the parent perspective analysis, this separation principle must be violated. Nevertheless, the ability to transfer funds among all of its operating units is a critical source of competitive advantage for an MNE. Therefore, the implications of blockages should be assessed before a foreign investment is made, and a strategy must be developed to deal with blockages if they occur. The parent perspective analysis focuses on the implications of the project for transferring funds and allows us to develop proper strategies for dealing with this issue prior to making the commitment and implementing the project.

China has a reputation for closely regulating funds flowing across its borders. Regulations are becoming more flexible as China continues to embrace capitalism and especially since it entered the WTO, but restrictions still exist. If SSI is to invest $15 million in China, it wants to be sure that it can get its money back on a reasonable timetable. The Business Development Team (BDT) was able to negotiate unrestricted remittance of cash dividends up to NOPAT less the required increase in net working capital, provided the company generates sufficient foreign exchange to offset the payment. (Yuan must be converted to dollars to make the dividend payment.) No withholding taxes are required for these payments. Contributed capital, though, must remain in China until the company decides to shut down the operation and leave the country or else sell it to Chinese nationals. This is the assumption made in the analysis at the end of the study period, when the terminal value of the required investment is assumed to be returned to SSI-USA. The BDT decided not to recommend a parent-to-subsidiary loan because money at a reasonable interest rate can be obtained from a local bank in Shanghai, given that the parent company will provide adequate equity capital. On the operating side, the BDT negotiated license fees to be used to pay for the advanced technology transferred to the Shanghai operation, plus a management fee to cover the Shanghai operation’s share of the entire corporation’s overhead. Many countries are sensitive about management fees, so such fees should be explicitly covered in negotiations with the host government. SSI decided to source all production inputs in China, as this will increase the project’s value to the Chinese and also avoid import licenses and transfer pricing issues, both of which are closely regulated by the government.

In the project perspective analysis, license fees and management fees were included in operating cash flows as expenses, hence they reduced the taxes paid in China. However, when the parent receives these fees, they represent taxable income and are taxed at the parent’s tax rate. Cash dividends sent to the parent from China were calculated as NOPAT minus the increase in required net operating working
capital. Taxes will already have been paid in China on these earnings, but when they are sent back to the United States, they will again be subject to taxation. In general, if the tax paid in the host country is less than what would have been paid on the same before-tax earnings in the United States, the IRS charges additional taxes when the dividends are repatriated to the parent. The calculation of this tax obligation is shown in Table 11-5.

On Row 90 of Table 11-5, the dividend repatriated to SSI-USA is NOPAT minus the investment in working capital. The figure needed to determine the U.S. tax liability is the before-tax equivalent of the dividend actually sent. This is shown on Row 92. To calculate the deemed-paid tax on Row 91, the dividend received is divided by NOPAT and then multiplied by the tax actually paid in the host country. For example, the Year 4 NOPAT is projected to be CNY 35.48 million, dividends received are CNY 33.48 million (calculated as NOPAT less the increase in required NOWC), and the taxes paid in China are CNY 23.654 million. Thus, the deemed-paid tax for Year 4 is 22.32 million yuan:

\[
\text{Deemed-paid tax} = \left( \frac{\text{Dividends received}}{\text{NOPAT}} \right) \times \text{Taxes paid} = \left( \frac{\text{CNY 33.48 million}}{\text{CNY 35.48 million}} \right) \times \text{CNY 23.654 million} = 0.943630 \times \text{CNY 23.654 million} = \text{CNY 22.32 million}.
\]

If we add this deemed-paid tax to the amount of the dividend, we obtain the grossed-up dividend shown on Row 92. The applicable U.S. federal-plus-state tax rate is assumed to be 40 percent, and Row 93 shows the tentative amount of tax due to the IRS. However, the company receives a foreign tax credit equal to the deemed-paid tax, which is reported on Row 94. Subtracting Row 94 from Row 93 gives the U.S. tax due on the foreign dividend shown on Row 95. Subtracting this from Row 90 gives the after-U.S.-tax dividend to the parent denominated in yuan on Row 96, and it is translated into dollars on Row 97. Note that no U.S. taxes are due in Years 4 and 5 because in those years the Chinese tax rate is the same as the U.S. rate. However, for Years 1, 2, and 3, U.S. taxes would be due when the dividends are repatriated to SSI-USA. Even though the subsidiary gets a “tax break” during the first three years of profitable operations, sending the money back to the United States wipes out the benefits to the company. This is why companies often

**Table 11-5** Calculation of the After-Tax Dividend (Currency in Thousands)

<table>
<thead>
<tr>
<th>Time period</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>G</td>
<td>H</td>
</tr>
<tr>
<td>90</td>
<td>Dividend Sent</td>
<td>0</td>
<td>41.397</td>
<td>30.917</td>
<td>41.124</td>
<td>30.496</td>
</tr>
<tr>
<td>92</td>
<td>Grossed-Up Dividend</td>
<td>41.397</td>
<td>41.146</td>
<td>51.405</td>
<td>56.501</td>
<td>64.284</td>
</tr>
<tr>
<td>95</td>
<td>U.S. Tax Due</td>
<td>41.278</td>
<td>31.101</td>
<td>36.126</td>
<td>30.276</td>
<td>38.578</td>
</tr>
<tr>
<td>96</td>
<td>A-T Dividend in Yuan</td>
<td>24.839</td>
<td>27.432</td>
<td>30.545</td>
<td>35.364</td>
<td>39.638</td>
</tr>
<tr>
<td>97</td>
<td>A-T Dividend in USD</td>
<td>USD 0</td>
<td>USD 3.000</td>
<td>USD 3.334</td>
<td>USD 3.725</td>
<td>USD 4.064</td>
</tr>
</tbody>
</table>

24 Some analysts believe that the correct figure to use in calculating the dividend is net income from the income statement instead of using NOPAT from the operating cash flow statement.
do not repatriate dividends from subsidiaries in countries whose tax rates are less than the U.S. rate.\textsuperscript{25}

Table 11-6 gives the cash flows required to analyze the Chinese project from the parent's perspective. Rows 102 and 103 represent the cash flows going from the parent to the subsidiary in the form of cash and machinery. License and management fees are taken from Table 11-3 and converted into dollars at the spot rate. The total fees sent to the parent are fully taxable at the U.S. tax rate of 40 percent, so the net fees after paying U.S. taxes are reported on Row 109. We add to this the after-tax dividend from Table 11-5 to obtain the total cash flow on Row 111.

Two adjustments must be made to the numbers on Row 111 to arrive at the parent cash flows. First, the cannibalism of after-tax profits from Germany also affects the parent, so we subtract these flows on Row 112. Also, the after-tax salvage values of the building, equipment, and working capital contributed above the initial allotment (remember the initial NOWC was financed with a local loan) are added back even though the company has no intention of abandoning the Shanghai operation. Their inclusion reflects the assumed Year 5 market value of the assets in place that are “owned” by the parent that could be realized by selling the operations to a Chinese company. Row 114 shows the parent cash flows. Discounting the parent’s cash flows at its foreign-risk-adjusted cost of capital, 11.75 percent, gives an NPV of approximately $1.8 million, an IRR of 8.14 percent, and a payback of 4.56 years. Because the NPV is negative, the project appears to be unprofitable from the parent perspective. Also, the same two caveats apply here that we mentioned in the project perspective analysis. First, the only reason the project “pays back” is because of the salvage value recovery. This is worrisome because the salvage value is especially uncertain. Second, if it is determined that subtracting the cannibalism value is

\begin{table}
\centering
\caption{Cash Flows from Parent Perspective (Currency in Thousands of Dollars)}
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline
\textbf{Time period} & 0 & 1 & 2 & 3 & 4 & 5 \\
\hline
\textbf{B} Equity Investment & -10,000 & & & & & \\
\textbf{C} Equipment & -5,000 & & & & & \\
\textbf{D} License Fee & 1,300 & 1,900 & 1,722 & 1,844 & 1,213 & \\
\textbf{E} Management Fee & 776 & 932 & 631 & 691 & 194 & \\
\textbf{F} Total Fee & 2,076 & 2,832 & 2,353 & 2,535 & 2,408 & \\
\textbf{G} U.S. Tax & -312 & -854 & -941 & -1,012 & -2,062 & \\
\textbf{H} Dividend (after-tax) & 1,264 & 1,327 & 1,412 & 1,023 & 700 & \\
\textbf{I} Total Cash Flow & 3,000 & 3,164 & 2,725 & 2,454 & 4,898 & \\
\textbf{J} Sales Cannibalism & 4,247 & 4,671 & 5,137 & 5,547 & 6,293 & \\
\textbf{L} Parent Cash Flow & -4,592 & 1,607 & 1,817 & 2,142 & 2,334 & 12,810 \\
\hline
\textbf{M} Financial results: & & & & & & \\
\textbf{N} NPV & -10,000 & -7,900 & -3,900 & -1,000 & -2,000 & \\
\textbf{O} IRR & 8.14\% & & & & & \\
\textbf{P} Payback & 4.56 & & & & & \\
\hline
\end{tabular}
\end{table}

\textsuperscript{25}This is a political issue as we write this text in 2004. Estimates indicate that hundreds of billions of U.S. taxes have been avoided by multinational U.S. firms that leave their profits overseas. Some see the existing tax regime as being necessary to compete in global markets, while others see it as providing a bonanza to multinational corporations.
not appropriate because Germany is able to use the freed-up production capacity to expand in other markets, the NPV will increase by $10.7 million, rising to $8.9 million. Note that cannibalization had a similar impact in the project perspective analysis, and this effect passes through directly to the parent as well. Also, if the going concern salvage value (adjusted for the yuan loan) is used instead of the liquidating value, the NPV will increase by nearly $14 million, more than enough to make the NPV positive.

The other procedure for adjusting for foreign risk is to build it into the cash flows. This can be done by adding (1) the cost of forward cover (i.e., purchasing forward contracts and thereby eliminating unexpected changes in the exchange rates) and (2) purchasing OPIC insurance and including the premium as a cost. The Overseas Private Investment Corporation is a development agency of the U.S. government that was established in 1971. According to its Web site, “OPIC helps U.S. businesses invest overseas, fosters economic development in new and emerging markets, complements the private sector in managing the risks associated with foreign direct investment, and supports U.S. foreign policy.” It does this by offering insurance coverage for most types of projects in almost all countries for three types of foreign risks: currency inconvertibility, expropriation, and political violence. Premiums for the various types of coverage generally fall in the range of $0.20 to $0.85 per $100 of coverage, depending on the nature of the industry and the country in question. It also offers enhanced inconvertibility coverage for an additional premium in some areas.

For this project, using the average premium charged for the three types of coverage offered for China, the unique foreign risk can be eliminated by a before-tax charge of $370,000 per year or $222,000 after taxes. We assume that OPIC insurance must be acquired at the beginning of the year, and the adjusted cash flows are shown in Table 11-7. At the domestic WACC of 8.76 percent, the present value increases to approximately $1.3 million even though the IRR decreases to 6.4 percent. This analysis suggests that SSI’s foreign direct investment risk premium, approximately 3 percent, might be a bit too high. It is still a marginal project from the parent perspective unless SSI changes its mind about the cannibalism issue or uses the “going concern” salvage value.

**Country Perspective Analysis**

The analyses shown in Tables 11-1 through 11-7 appear quite precise and provide consistent NPV results that signal the project’s marginal acceptability. While it is theoretically possible to quantify the project’s value to the country, we will not go...
into detail on this topic. Instead, we list in Table 11-8 the information that SSI’s Business Development Team used to negotiate with Chinese government authorities. Note that the project would bring no disadvantages to China, but if there had been disadvantages, they would also be shown in Table 11-8.

SSI’s team made the points listed in Table 11-8 in its negotiations with the Chinese authorities. Even though such a listing may seem overly simplistic, it has three important uses: (1) It allows SSI-USA’s management to assess whether the project adds value to the host country. If it does not, then the project will probably not be allowed, or if it is permitted, then it may experience problems down the road. (2) Because the host country is vitally concerned with its balance of payments position and its trade position, this list reassures the government that the project will help them manage the economy. Most emerging markets, but also advanced industrial countries, are keenly interested in this impact of FDI. (3) The project makes a contribution to politically important areas such as job creation, training, social services, and technology access. Governments are comprised of politicians, and projects that contribute positively to their political agenda tend to be looked upon favorably.

In the initial negotiations between SSI and local Shanghai officials, the Chinese took a hard-line stance about license fees, withholding taxes on remittances abroad, and transfer prices for imported components. At first, management fees were not

### Table 11-8: Project’s Contribution to China

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export sales in hard currency</td>
<td>$299,196,000</td>
</tr>
<tr>
<td>Less: dollar remittances to the parent</td>
<td>34,944,000</td>
</tr>
<tr>
<td>Net inflow of hard currency</td>
<td>$264,252,000</td>
</tr>
</tbody>
</table>

- The project will create approximately 75 jobs in the first year, mainly semiskilled, and provide training and social services for these workers. Additional hiring is expected in later years as production expands. The new workers will be trained to do their jobs, so they will not be hired away from local companies.

- This net inflow of hard currency will be a net credit balance in China’s current account and serve to increase the huge trade surplus China is running with the United States. Because China is running a large budget deficit, the extra hard currency represents an additional buffer to ensure that the country can continue its rapid rate of growth.

- The initial investment inflow of $15,000,000 will be reported as a credit balance in the capital account of China’s balance of payments.

- Chinese tax authorities will collect taxes in the amount of CNY 69,878,000 or $8,439,372.

- There will be a transfer to China of proprietary process technology embodied in specialized equipment, and local workers will be trained to use the technology.

- The project will develop industrial capacity in a product line that has no competitors in China, so it will enable China to expand its export reach.

- All inputs will be sourced in China, thus increasing the profits of local companies and perhaps creating some new suppliers to meet the needs of the company.

- The project is relatively “clean”—it will not add to China’s environmental problems. SSI will use state-of-the-art containment technology to ensure that no pollutants are released into the atmosphere or water.

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26 The World Bank has developed a methodology using economic shadow prices that it calls economic analysis to perform such calculations. It is left to interested readers to delve into this methodology on their own.

27 China is running a huge trade surplus with the U.S. and it has huge holdings of U.S. Treasury securities. Thus China, unlike many developing nations, has no problem with obtaining hard currencies to use to purchase import goods. However, China does want to keep foreign investors in the country, hence it restricts repatriating funds. Also, the yuan is by most accounts undervalued, which the Chinese like because it stimulates exports and thus economic growth. If companies like SSI could freely buy dollars with yuan for repatriation purposes, this would strengthen the yuan, and this is another reason for restricting the repatriation rules.
permitted. However, as negotiations progressed and government officials recognized the potential contributions of the investment, they relaxed their initial positions, leading to increased profitability for SSI. Thus, developing a country analysis as a negotiating tool clarified the project’s impact on things that were important to the local officials, and the BDT found it useful for this purpose.28 At this point the company managers are disappointed that the project is not as profitable for SSI as they expected it to be. They are inclined to think that using the going concern salvage value is justifiable, because SSI is not likely to pull out in five years if it invests. However, opinions on cannibalization are mixed. What is abundantly clear, though, is that more information is needed before the BDT should recommend the project to the board of directors. Thus, they need to perform a full risk analysis to put the project’s uncertainties into better perspective. This analysis will be taken up in Chapter 12.

What are the two different treatments for estimating salvage values? Identify and explain the three different classifications of cash flow. What are the two main approaches for handling projects with cash flows that are denominated in foreign currencies? What are the differences among the project perspective, the parent perspective, and the country perspective analyses?

28For an example of how such information can lead to a redesign of the project in a manner that increases the NPV to the company, as well as the benefits to the country, see Lee A. Tavis and Roy L. Crum, “Performance-Based Strategies for MNC Portfolio Balancing,” The Columbia Journal of World Business, Summer 1984, 85–94.

**Summary**

In this chapter, we discuss the basic concepts of capital budgeting and then illustrate how international factors affect the capital budgeting process. We discuss how payback, net present value, and internal rate of return are used to evaluate capital budgeting decisions. Each method provides different information, so managers look at all of them when evaluating projects. However, NPV is the best single measure, and almost all firms now use NPV. Although purely domestic and multinational companies use the same conceptual framework, capital budgeting is more complicated for multinationals because they must decide where to locate operations, worry about fluctuations in exchange rates, and consider their ability to repatriate cash flows from foreign operations to the parent. This chapter illustrates the evaluation of a foreign project from a project perspective, a parent perspective, and a country perspective. The differences among these three types of analyses are highlighted. The key concepts discussed in this chapter are listed below.

- **Capital budgeting** is the decision process that managers use to identify those projects that add to the firm's value. The same general concepts that are used in security valuation are also involved in capital budgeting. Whereas a set of stocks and bonds exists in the securities market, capital budgeting projects are created by the firm.
- Firms generally categorize projects into five main classifications: replacement for maintenance of business, replacement for cost reduction, expansion of existing products or markets (including international markets), expansion into new products or markets, and downsizing and plant relocation decisions.
- The **payback period** is the length of time required for an investment's net revenues to cover its cost. The shorter the payback period, the better the project is.
- Payback has three advantages: (1) It is simple to calculate; (2) it is easy to understand; and (3) it provides an indication of both the risk and liquidity of different projects by showing how long the firm's money will be tied up (indicating relative
liquidity) and that the project's cash flows must be forecasted way out into the future (indicating relative risk).

- Payback has three very serious flaws: (1) It ignores the time value of money because it gives equal weight to dollars received in different years; (2) it does not consider cash flows that occur after the payback year; and (3) it does not have a natural (market-determined) benchmark to differentiate between acceptable and unacceptable projects.

- Mutually exclusive projects are a set of projects in which only one project can be accepted.

- Independent projects are those whose cash flows are not affected by the acceptance or nonacceptance of other projects.

- The net present value (NPV) method is a method of ranking investment proposals using the NPV, which is equal to the present value of future net cash flows discounted at the cost of capital. It gives a direct measure of the project's dollar benefit to shareholders. A project should be accepted if the NPV is positive.

- The internal rate of return (IRR) is the discount rate that forces the present value of a project's inflows to equal the present value of its costs. If a project's IRR exceeds its cost of capital, then it will earn an extra return that will go to stockholders, and that leads to a higher firm value. IRR measures profitability, but it is expressed in terms of percentage rate of return.

- The internal rate of return method is a method of ranking investment proposals using the rate of return on an investment, calculated by finding the discount rate that equates the present value of future cash inflows to the project's cost. The project should be accepted if the IRR is greater than the cost of capital.

- The NPV and IRR criteria always lead to the same accept/reject decisions for independent projects. If the NPV is positive, then the IRR must exceed the WACC. However, NPV and IRR can give conflicting rankings for mutually exclusive projects. Logic suggests that NPV is a better decision criterion than IRR because NPV selects the project that adds the most to shareholder wealth.

- A net present value profile is a graph showing the relationship between a project's NPV and the different values for firm's cost of capital.

- The crossover rate is the cost of capital at which the NPV profiles of two projects cross and, thus, at which the projects' NPVs are equal.

- In the real world, a quantitative analysis using NPV, IRR, and payback is not the sole determinant in important capital budgeting decisions. Qualitative factors should also be considered. Informed capital budgeting decisions should be the product of sound managerial judgment that reflects qualitative factors as well as quantitative measures.

- The most important, but also the most difficult, step in capital budgeting is estimating projects' cash flows.

- International projects are even more difficult to analyze than domestic ones because of at least three different factors: (1) The quality of data available in many countries is very poor and forecasting is subject to significant errors; (2) exchange rates are often hard to forecast, and they rely on assumptions such as purchasing power parity or interest rate parity; and (3) many of the costs associated with foreign projects are subject to political negotiations with host governments instead of being determined in the marketplace.

- A proper analysis of forecasts includes (1) obtaining information from various departments, (2) ensuring that everyone involved with the forecast uses a consistent set of economic assumptions, and (3) ensuring that no biases exist in the forecasts.

- Relevant cash flows are defined as the specific cash flows that should be considered in a capital budgeting decision. Only incremental cash flows, those cash flows representing the change in the firm's total cash flow that occurs as a direct result of accepting a project, are relevant.

- Free cash flow is the cash flow available for distribution to all investors. A project's relevant cash flow is the additional free cash flow that the company expects from the project.
Project cash flow is different from accounting income. Project cash flow reflects (1) cash outlays for fixed assets, (2) the tax shield provided by depreciation, and (3) cash flows due to changes in net operating working capital. Project cash flow does not include interest payments.

In determining incremental cash flows, opportunity costs (the cash flows foregone by using an asset) must be included, but sunk costs (cash outlays that have been made and that cannot be recouped) are not included. Any externalities (effects of a project on other parts of the firm) should also be reflected in the analysis.

Cannibalization occurs when a new project leads to a reduction in sales of an existing product. To the extent that a new project takes sales from existing corporate sales, the new project’s estimated profits should be reduced by earnings lost on existing sales.

Inflation effects must be considered in project analysis. If the component costs of capital include an inflation premium, as they typically do, but the cash flows are all stated in constant purchasing power dollars, then the calculated NPV will be lower than the true NPV. The most common inflation adjustment procedure is to build expected inflation into the cash flow estimates. For companies that operate in high inflation environments, it is often useful to do the analysis in both nominal and real (constant currency) terms.

The incremental cash flows from a typical project can be classified into three categories: (1) required investment, (2) annual operating cash flows over the project’s life, and (3) terminal year cash flow.

Firms must consider additional issues when undertaking international capital budgeting projects, such as exchange rates, political risk, and repatriation of funds. All will influence a foreign project’s capital budgeting analysis.

Additional foreign risks need to be incorporated into the formal project analysis, and there are two very different approaches: (1) Traditionally, risk is incorporated in the analysis by increasing the risk premium in the discount rate to account for the added uncertainties. (2) The other alternative is to make the adjustment to the cash flows and then to discount at a domestic rate that does not adjust for the unique foreign risks.

The project perspective is the evaluation of a capital budgeting project from the perspective of a local company undertaking a project.

The parent perspective is the evaluation of a capital budgeting project from the perspective of the parent company, which is mainly concerned with the cash flows to be realized by the parent.

The country perspective is the evaluation of a capital budgeting project from the perspective of the host country and the benefits to be realized.

There are two methods for estimating salvage values. (1) The liquidating value concept estimates the market value of the fixed assets, adjusted for taxes, and adds the value of recovered NOWC. (2) The going concern concept estimates the salvage value by taking the final year of the study period’s NOCF, increasing it by 1 + growth rate in NOCF and dividing it by the difference between WACC and g. This, of course, is the formula for calculating the present value of a constantly growing perpetuity.

There are essentially two main approaches for handling projects whose cash flows are denominated in foreign currencies: (1) Estimate the project cash flows in the foreign currency, discount them at the appropriate foreign-based discount rate, and then convert the foreign-denominated NPV at the spot exchange rate to a dollar-denominated NPV. (2) Estimate project cash flows in the foreign currency, use forward exchange rates or an alternative foreign exchange rate forecasting model to convert foreign cash flows to dollars, and then calculate the dollar-denominated NPV using an appropriate U.S.-based discount rate.

These two approaches for evaluating international projects will yield the same answer if foreign exchange parity conditions hold perfectly. However, in practice, deviations from parity conditions occur, so both approaches are used.
Chapter 11  
CHAPTER 11  Capital Budgeting: The Basics

Questions

(11-1) Briefly explain how the valuation equation relates to capital budgeting.

(11-2) Why are capital budgeting decisions considered one of the most important tasks faced by financial managers and their staffs?

(11-3) Briefly explain whether the following statement is true or false: “The same general concepts that are used in security valuation are also involved in capital budgeting.”

(11-4) Identify the five general capital budgeting classifications, and differentiate how a capital budgeting decision would be made in each classification.

(11-5) Identify the advantages and disadvantages of payback.

(11-6) What is the decision rule for payback? In other words, when would a project be accepted under this decision method?

(11-7) What steps are involved when analyzing a project using the NPV method?

(11-8) How does the NPV equation relate to the general valuation equation given at the introduction to the chapter?

(11-9) What is the decision rule for NPV?

(11-10) When a firm is considering a foreign project, what two approaches using the NPV methodology can be used?

(11-11) Differentiate between the equation used to solve for NPV and the one used to solve for IRR.

(11-12) What is the decision rule for IRR?

(11-13) Do the NPV and IRR decision methods always lead to the same capital budgeting decisions? Explain.

(11-14) What information is provided by each of the following decision methods: (1) payback, (2) NPV, and (3) IRR?

(11-15) Briefly explain whether the following statement is true or false: “Financial managers base their capital budgeting decisions solely on quantitative analyses.”

(11-16) Why is it so difficult to estimate a project’s cash flows?

(11-17) What are the relevant cash flows for an international investment—the cash flows produced by the subsidiary in the country where it operates or the cash flows in the home currency that it sends to its parent company?

(11-18) What two cardinal rules can help you minimize mistakes when estimating cash flows?

(11-19) Why must depreciation be added back to NOPAT when estimating a project’s cash flow?

(11-20) Why is interest expense not included in a project’s cash flows?

(11-21) Briefly explain how sunk costs, opportunity costs, externalities, and cannibalization affect a project’s cash flows.

(11-22) Why will ignoring inflation “corrupt” a capital budgeting analysis, and how should you incorporate inflation into the analysis?

(11-23) Briefly explain the three categories into which a project’s incremental cash flows can be classified.

(11-24) If you were responsible for analyzing a capital project, what information would you need to begin your analysis, and what steps would you use to proceed with your analysis?
What additional complications arise when one is considering an international capital budgeting project?

Why do U.S. corporations build manufacturing plants abroad when they could build them at home?

**Self-Test Problems**

**ST-1** Define each of the following terms:

a. Capital budgeting
b. Payback period; net present value (NPV); net present value method; internal rate of return (IRR); internal rate of return method
c. Mutually exclusive projects; independent projects
d. Net present value profile; crossover rate
e. Relevant cash flows; incremental cash flows
f. Sunk cost; opportunity cost; externalities; cannibalization
g. Project perspective; parent perspective; country perspective

**ST-2** Global Publishing, a U.S. multinational, is considering entering a new line of business in Great Britain. In analyzing the potential business, their financial staff has accumulated the following information:

- The new business will require a capital expenditure of £5 million at \( t = 0 \). This expenditure will be used to purchase new equipment.
- This equipment will be depreciated at rates of 33 percent, 45 percent, 15 percent, and 7 percent, respectively.
- The equipment will have no salvage value after 4 years.
- If Global goes ahead with the new business, inventories will rise by £500,000 at \( t = 0 \), and its accounts payable will rise by £200,000 at \( t = 0 \). This increase in net operating working capital will be recovered at \( t = 4 \).
- The new business is expected to have an economic life of 4 years. The business is expected to generate sales of £3 million at \( t = 1 \), £4 million at \( t = 2 \), £5 million at \( t = 3 \), and £2 million at \( t = 4 \). Each year, operating costs excluding depreciation are expected to be 75 percent of sales.
- The company’s tax rate is 40 percent.
- The company is very profitable, so any accounting losses on this project can be used to reduce the company’s overall tax burden.
- The project’s cost of capital, which includes a foreign exchange risk premium, is 10 percent.
- The spot exchange rate is $1.65 per pound.

a. Use the NPV method to estimate the project’s cash flows in pounds, and then use the spot exchange rate to convert the pound-denominated NPV to a dollar-denominated NPV. What is the project’s NPV (stated in U.S. dollars)?

b. Assume now that the pound is expected to depreciate by 2 percent per year during the project’s life. In addition, the project’s cost of capital, excluding the foreign exchange risk premium, is 9.6 percent. Estimate the project’s cash flows in pounds, and then use the expected exchange rates to convert to dollar-denominated cash flows. What is the project’s NPV (stated in U.S. dollars)? (Hint: Because the cash flows have been adjusted for foreign exchange risk, no such adjustment is needed for the WACC.)

**Starter Problems**

**11-1** a. Project X requires an initial investment of $60,000, its annual after-tax cash flows (including depreciation) are expected to be $14,000 for 7 years, and its cost of capital is 9 percent. What is the project’s payback period?
b. Assume now that Project X is one of many projects of a U.S. firm; however, it is located in Argentina. If the Argentinean peso were expected to depreciate relative to the U.S. dollar, would you expect the project’s payback period to be shorter, longer, or the same as the one calculated in part a? Assume that differences in the project’s cash flows are strictly related to differences in exchange rates.

(11-2) a. Project Y requires an initial investment of $100,000 and produces annual after-tax cash flows (including depreciation) of $30,000 in Years 1 through 3 and $20,000 in Years 4 and 5. If the project’s cost of capital is 10 percent, what is Project Y’s NPV?

b. Assume now that Project Y is one of many projects of a British company, Heath & Smythe (H&S). The spot exchange rate is $1.5776 per pound. Calculate the project’s pound-denominated NPV by using the spot exchange rate to convert the dollar-denominated NPV to a pound-denominated NPV. Assume that 10 percent is the appropriate WACC. Should H&S undertake this project?

c. Again, assume that Project Y is one of many projects of Heath & Smythe. Assume that the dollar is expected to depreciate against the pound by 1 percent per year during this project’s life. Estimate the project’s cash flows in dollars, and then use the expected rates to convert to pound-denominated cash flows. Assume that a 9.7 percent WACC appropriately excludes the foreign exchange rate risk premium. Should H&S undertake this project?

(11-3) a. Project Z is expected to produce annual after-tax cash flows of $15,000, $20,000, $20,000, and $25,000 over the next 4 years. To initiate Project Z, a $55,000 investment must be made today. What is Project Z’s IRR?

b. Assume that Project Z is one of many projects of a Canadian firm, British Columbia Enterprises. The spot exchange rate is CAD 1.3958 per U.S. dollar. From the Canadian firm’s perspective, once cash flows are converted to Canadian dollars, what is the project’s IRR?

(11-4) LLT International is considering expanding its technological development facilities in New Zealand. The spot exchange rate is NZD 1.7544 per U.S. dollar; however, the New Zealand dollar is expected to depreciate in value relative to the U.S. dollar by 2 percent next year. LLT’s financial staff has made the following estimates (stated in New Zealand dollars) of incremental changes for the next year due to the expansion project:

- Increased sales revenue: NZD 15 million
- Operating costs (excluding depreciation): NZD 9 million
- Depreciation expense: NZD 4 million
- Interest expense: NZD 3 million

The firm is subject to a 40 percent tax rate. What is the project’s estimated U.S. dollar-denominated operating cash flow for the first year of operations (t = 1)?

(11-5) Walton International Communications is evaluating a new project, which will be located in Hong Kong, and it will require the purchase of an HKD 12 million facility. Walton also will have to spend HKD 5 million to purchase new equipment necessary for the project. To help finance the project, Walton must increase its net operating working capital by HKD 2 million. The spot exchange rate is HKD 7.7992 per U.S. dollar. If the company’s tax rate is 40 percent, what is the project’s initial investment outlay stated in terms of U.S. dollars?

(11-6) Three years ago, Garvin purchased $13 million of equipment. Garvin depreciated the equipment using the 3-year MACRS accelerated depreciation method. The appropriate 3-year MACRS depreciation rates are 33 percent, 45 percent, 15 percent, and 7 percent. Garvin expects to sell the used equipment today for $1 million. If the company’s tax rate is 40 percent, what is the equipment’s after-tax net salvage value?
Kaufman Enterprises, a U.S. multinational, is evaluating two independent projects (Projects A and Z) of its British subsidiary for inclusion in this year’s capital budget. The projects are of equal risk and should be evaluated at a risk-adjusted 11 percent cost of capital, which includes the foreign exchange risk premium. The projects’ after-tax cash flows (stated in pounds), including depreciation, are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Project A (£)</th>
<th>Project Z (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(£120,000)</td>
<td>(£75,000)</td>
</tr>
<tr>
<td>1</td>
<td>20,000</td>
<td>30,000</td>
</tr>
<tr>
<td>2</td>
<td>20,000</td>
<td>30,000</td>
</tr>
<tr>
<td>3</td>
<td>50,000</td>
<td>30,000</td>
</tr>
<tr>
<td>4</td>
<td>50,000</td>
<td>10,000</td>
</tr>
<tr>
<td>5</td>
<td>50,000</td>
<td>10,000</td>
</tr>
</tbody>
</table>

The spot exchange rate is $1.45 per pound. Calculate payback, NPV, and IRR for each project. Indicate the correct accept/reject decision for each criterion. For purposes of answering this question, assume Kaufman requires a payback of 3 years or less.

Rao Technologies is considering a project that is expected to generate annual after-tax cash flows of $2,200 for each of the next 20 years. The project’s cost of capital is 8.5 percent, and it has an IRR of 9.058 percent. What is this project’s NPV?

a. Project Alpha is expected to produce annual after-tax cash flows (including depreciation) of $20,000 for the next 7 years. It requires an initial investment of $75,000 and an additional investment of $25,000 at the end of the 4th year. The project’s cost of capital is 10 percent. What are Project Alpha’s NPV and IRR?

b. Assume that Project Alpha is one of many projects of a Japanese firm, Tokyo Manufacturing Company (TMC). The spot exchange rate is ¥117.425 per U.S. dollar. Assume that 10 percent is the appropriate WACC. From the Japanese firm’s perspective, once cash flows are converted to yen, what are Project Alpha’s NPV and IRR? Should TMC undertake the project?

c. Assume again that Project Alpha is one of many projects of Tokyo Manufacturing Company (TMC). Assume now that the yen is expected to depreciate in value relative to the U.S. dollar by 0.5 percent per year during the life of this project. Assume that a 9.2 percent WACC appropriately excludes the foreign exchange rate risk premium. From the Japanese firm’s perspective, once cash flows are converted to yen, what are Project Alpha’s NPV and IRR? Should TMC undertake this project?

Murphy Chemicals is considering two mutually exclusive investments with the following after-tax cash flows (including depreciation):

<table>
<thead>
<tr>
<th>Year</th>
<th>Project X ($)</th>
<th>Project Y ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>($3,000)</td>
<td>($6,000)</td>
</tr>
<tr>
<td>1</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>2</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>3</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>4</td>
<td>1,750</td>
<td>3,000</td>
</tr>
<tr>
<td>5</td>
<td>1,750</td>
<td>3,000</td>
</tr>
</tbody>
</table>

a. What is each project’s IRR?
b. Construct NPV profiles for Projects X and Y.
c. For what range of WACCs would Murphy Chemicals choose to accept Project X?

Bruner Fashions, a U.S. multinational, has a subsidiary located in Australia. Average-risk projects in this subsidiary have a weighted average cost of capital of 10.5 percent, which includes a foreign exchange risk premium. Bruner is considering two mutually exclusive, average-risk projects for its new Australian facility. Each requires an initial investment of AUD 4 million. The projects are expected to produce the following after-tax cash flows, including depreciation (stated in Australian dollars):

<table>
<thead>
<tr>
<th>Year</th>
<th>Project A</th>
<th>Project B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AUD 1,500,000</td>
<td>AUD 2,500,000</td>
</tr>
<tr>
<td>2</td>
<td>1,500,000</td>
<td>1,500,000</td>
</tr>
<tr>
<td>3</td>
<td>1,500,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>4</td>
<td>1,500,000</td>
<td>500,000</td>
</tr>
</tbody>
</table>

The spot exchange rate is AUD 1.5623 per U.S. dollar. There is no limitation on the repatriation of funds, so all project cash flows will be available to Bruner.

a. What are the projects’ U.S. dollar-denominated net present values, and which project should be selected by Bruner? To answer this question, estimate the projects’ cash flows in Australian dollars, and then use the spot exchange rate to convert the Australian-dollar-denominated NPVs to U.S.-dollar-denominated NPVs.

b. Assume that the Australian dollar is expected to appreciate in value relative to the U.S. dollar by 2.5 percent per year over the project’s life. In addition, assume that the appropriate WACC excluding the foreign exchange risk premium is 10.2 percent. What are the projects’ U.S.-dollar-denominated net present values, and which project should be selected by Bruner? To answer this question, estimate the projects’ cash flows in Australian dollars and then use the expected exchange rates to convert to U.S.-dollar-denominated cash flows. (Hint: Because the cash flows have been adjusted for foreign exchange risk, no such adjustment is needed for the WACC.)

Holmes Waste Disposal is legally required to clean up a former dumping site to minimize the ecological damage done to the area. Two alternatives have been suggested: a quick cleanup plan (with larger costs early in the plan) and a slow cleanup plan (with smaller costs spread out over a longer time period). Holmes is only required to complete the cleanup in 6 years, although the quicker the cleanup effort moves, the better off the area’s ecosystem will be. The after-tax costs of the two plans are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Quick Plan</th>
<th>Slow Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>($800,000)</td>
<td>($300,000)</td>
</tr>
<tr>
<td>1</td>
<td>(500,000)</td>
<td>(300,000)</td>
</tr>
<tr>
<td>2</td>
<td>(500,000)</td>
<td>(300,000)</td>
</tr>
<tr>
<td>3</td>
<td>(50,000)</td>
<td>(300,000)</td>
</tr>
<tr>
<td>4</td>
<td>(50,000)</td>
<td>(300,000)</td>
</tr>
<tr>
<td>5</td>
<td>(50,000)</td>
<td>(300,000)</td>
</tr>
<tr>
<td>6</td>
<td>(50,000)</td>
<td>(300,000)</td>
</tr>
</tbody>
</table>

Holmes has assigned a 10 percent cost of capital to each project. From a financial perspective, which plan should be adopted? From a societal benefit perspective, which plan should be adopted?
McCormick Solutions, a U.S. multinational, is considering instituting a new inventory identification system to improve its efficiency in its Swiss plants. Although the system costs SwF 5 million, it is expected to reduce operating costs associated with inventory management by SwF 800,000 per year in after-tax cash flows for the next 10 years. The spot exchange rate is SwF 1.4114 per U.S. dollar. After 10 years, the system is expected to be obsolete and retired with no salvage value. The firm's cost of capital is 9.6 percent, including a foreign exchange risk premium. What are the project's payback, NPV, and IRR?

Yerkes International, a U.S. multinational, uses the NPV method to decide between mutually exclusive projects. Yerkes is currently evaluating two product delivery systems for its operations in Germany. Both projects require a €200,000 initial investment and have a 9.8 percent cost of capital, which excludes a foreign exchange risk premium. The two systems have the following after-tax cash flows, including depreciation (stated in euros):

<table>
<thead>
<tr>
<th>Year</th>
<th>Project C</th>
<th>Project D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>€20,000</td>
<td>€110,000</td>
</tr>
<tr>
<td>2</td>
<td>40,000</td>
<td>90,000</td>
</tr>
<tr>
<td>3</td>
<td>50,000</td>
<td>20,000</td>
</tr>
<tr>
<td>4</td>
<td>80,000</td>
<td>20,000</td>
</tr>
<tr>
<td>5</td>
<td>120,000</td>
<td>20,000</td>
</tr>
</tbody>
</table>

The spot exchange rate is €0.9173 per U.S. dollar; however, the euro is expected to depreciate by 1.5 percent per year over the next 5 years. What is the IRR of the better project’s dollar-denominated cash flows, if cash flows are adjusted for expected exchange rates?

Bailey Communications, a U.S. multinational, is evaluating the proposed acquisition of a new satellite system in Italy that will boost its transmission area in Europe. The satellite system will cost €25 million and will require an increase in net operating working capital of €1.5 million. The analysis will focus upon the next 4 years, in which the new satellite system is expected to provide additional revenues of €13.25 million per year and incur operating costs of €2 million per year. The system will be depreciated at rates of 33 percent, 45 percent, 15 percent, and 7 percent, respectively. After 4 years, the satellite system is expected to have no salvage value, but the increase in net operating working capital will be fully recovered.

The spot exchange rate is €0.95 per U.S. dollar. The project’s cost of capital, which includes a foreign exchange risk premium, is 10 percent, and the firm’s tax rate is 30 percent. The company is extremely profitable; and the satellite represents just one project for the firm, so losses in any one year on this project can be used to partially offset taxes paid on the company’s other projects.

a. What is the project’s dollar-denominated NPV? To answer this question, estimate the project’s cash flow in euros, and then use the spot exchange rate to convert the euro-denominated NPV to a dollar-denominated NPV.

b. In part a, Bailey Communications performed an NPV analysis from the project perspective. Now, the firm is interested in analyzing the project from a parent perspective. Assume that the $2 million in operating costs includes $750,000 of annual license and management fees, the U.S. tax rate is 40 percent, and the spot exchange rate between euros and dollars is a good indicator of what exchange rates will be during the next 4 years. What are the after-tax dividends (stated both in euros and dollars) repatriated to the firm during the project’s life? What is the project’s dollar-denominated NPV from the parent perspective?
Integrated Case

Rick Schmidt, MRI’s CFO, along with Mandy Wu, Schmidt’s assistant, and John Costello, a consultant and college finance professor, comprise a team set up to teach MRI’s directors and senior managers the basics of international financial management. The program includes 16 sessions, each lasting about 2 hours, which are held immediately before the monthly board meetings. Ten sessions have been held, and they have included studies of exchange rates, risk analysis, financial statements, bond valuation, stock valuation, and the cost of capital. The team is now preparing Session 11, which will deal with the basics of capital budgeting. The next session will extend the discussion of capital budgeting to formal procedures dealing with risk.

The introductory capital budgeting session will focus on two main points: (1) The different criteria that are used to evaluate proposed capital expenditures and (2) identifying the cash flows that are relevant in capital budgeting decisions. The team decided that the session would be most productive if they analyze an actual decision that MRI now faces: whether or not to produce a new heat-sensing device that would be used by airlines to determine if passengers are too sick to be allowed on flights. After the SARS epidemic in 2003, airlines are very much interested in such capabilities in order to protect other passengers and thus to convince the flying public that airline travel is safe. The project has been dubbed HSD, for heat-sensing device, in internal discussions, and Schmidt is quite sure the directors will be interested in analyzing it in detail.

The devices will be sold to airlines all over the world, and they are small enough to be transported economically by airfreight. Therefore, they can be manufactured anywhere, in the United States or overseas. Other things held constant, MRI favors basing its operations in the United States, but if a project would be more profitable based elsewhere, then management will not hesitate to locate a facility overseas. For the HSD project, the most promising overseas location is northern Italy. MRI has several facilities in the Milan area, and the labor force in northern Italy is highly skilled, which is important for a high-tech product such as HSD. Italy also has the advantages of a relatively stable government, operating in the euro zone, and no significant repatriation problems. Therefore, Schmidt wants to evaluate the project in Italy. He has stressed to his global management team to look at issues from all angles and, therefore, wants the project analyzed from the project perspective, parent perspective, and the country perspective. Schmidt has instructed MRI’s staff to use a risk adjustment of 1.5 percent above its WACC, since the project is being carried out in Italy. That assessment may change later.

MRI has a capital budgeting model that is used to analyze all proposed projects, with modifications made to accommodate specific situations. The model is used to obtain the most-likely estimates of NPV, IRR, and payback for each location, and then it is run under alternative sets of assumptions to get an idea of the project’s riskiness. Schmidt, Wu, and Costello plan to restrict their analysis in the upcoming session to the most-likely results and then, in the next session, go on to include risk analysis.

Table IC11-1 shows the basic assumptions regarding the HSD project in Italy. There are several important things to note about the input data. Some of the directors have criticized the choice of Italy for this project. They cite labor costs that are similar to U.S. labor costs and far exceed labor costs if taken to the Far East or Latin America. Schmidt has maintained that alternate locations, while cheaper, will not provide MRI the skilled labor it requires for this project. In addition, he has noted that he has negotiated higher license and management fees with the Italian government than has been possible with any other nation. Also, required NOWC will be funded by a loan borrowed by the subsidiary from a local lender. Fixed assets will be depreciated using the straight-line method and are expected to be worth 15 percent above book value at the end of the project. And the project is expected to take away from a less-sophisticated security device MRI is currently selling. That product is produced at a plant in the southeastern United States and the unit responsible has a profit margin of 6 percent.

In addition, Table IC11-2 was created to list the advantages as well as disadvantages this project brings to Italy. MRI’s Business Development Team used these points listed in Table IC11-2 to negotiate with Italian government authorities. Note that this project would bring no disadvantages to Italy.

Wu stated that she thought it would be best to lead off with an explanation of the three capital budgeting criteria, using a simplified set of data. Schmidt and Costello agreed, so they decided to use the following data for illustrative purposes:

<table>
<thead>
<tr>
<th>Year (t)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project S</td>
<td>($10,000)</td>
<td>8,000</td>
<td>3,000</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Project L</td>
<td>(10,000)</td>
<td>1,000</td>
<td>2,000</td>
<td>5,000</td>
<td>7,500</td>
</tr>
</tbody>
</table>

Also for illustrative purposes, they plan to assume a 10 percent cost of capital.
### Table IC11-1: Input Data for HSD’s Project in Italy (All Euros and Dollars in Thousands)

<table>
<thead>
<tr>
<th>Investment and Financing</th>
<th>First-Year Projections and Growth Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent investment</td>
<td>Local sales</td>
</tr>
<tr>
<td>Cash USD 12,000</td>
<td>Unit sales 15,000</td>
</tr>
<tr>
<td>Manufacturing equipment</td>
<td>Expected growth 5%</td>
</tr>
<tr>
<td>Subsidiary investment</td>
<td>Sales price (per unit) EUR 10.50</td>
</tr>
<tr>
<td>Locally borrowed funds (NOWC) EUR 4,900</td>
<td>Export sales</td>
</tr>
<tr>
<td>Local borrowing rate 6%</td>
<td>Unit sales 6,000</td>
</tr>
<tr>
<td>Required Asset Investment</td>
<td>Expected growth 7%</td>
</tr>
<tr>
<td>Building cost EUR 7,700</td>
<td>Sales price (per unit) USD 13.0</td>
</tr>
<tr>
<td>Mechanical equipment EUR 3,800</td>
<td>Direct materials (per unit) EUR 2.15</td>
</tr>
<tr>
<td>Electronic equipment EUR 3,250</td>
<td>Expected growth 1.5%</td>
</tr>
<tr>
<td>Annual increase in NOWC</td>
<td>Direct labor (per unit) EUR 4.75</td>
</tr>
<tr>
<td>Project life 5</td>
<td>General and administrative expenses EUR 55,500</td>
</tr>
<tr>
<td>Building depreciable life 20</td>
<td>Expected growth 1.5%</td>
</tr>
<tr>
<td>Mechanical equipment depreciable life 10</td>
<td>Insurance EUR 600</td>
</tr>
<tr>
<td>Electronic equipment depreciable life 5</td>
<td>Expected growth 1.5%</td>
</tr>
</tbody>
</table>

### Table IC11-2: Project’s Contribution to Italy

- The project will create approximately 300 jobs in the first year, about half skilled and the rest semi-skilled, and provide training for these workers. Additional hiring is expected in later years as production expands.
- The export sales will be a net credit balance in Italy’s current account, so it will not put downward pressure on the country’s ability to support the euro.
- Italian tax authorities will collect taxes in the amount of €11,212,043.
- There will be a transfer to Italy of proprietary process technology embodied in specialized equipment, and local workers will be trained to use the technology.
- All inputs will be sourced in Italy, thus increasing the profits of local companies and perhaps creating some new suppliers to meet the needs of the company.
- The project, as proposed, is relatively “clean”—it will not add to Italy’s environmental problems. MRI will use state-of-the-art containment technology to ensure that no pollutants are released into the atmosphere or water.
Wu, Schmidt, and Costello then compiled the following set of questions, which they plan to discuss during the session. As with the other sessions, they plan to use an Excel model to answer the quantitative questions. Assume that you are Mandy Wu and that you must prepare answers for use during the session.

**QUESTIONS**

a. What are the three most commonly used capital budgeting decision rules? What are the primary advantages and disadvantages of each? Is one of them better than the others, and if so, why should the team explain more than the best method?

b. Now, for the illustrative data, calculate the values for each of the three decision criteria. If the two projects are independent, should they be accepted?

c. Now suppose Projects S and L are mutually exclusive. Which one, if either, should be accepted? Some of the directors are likely to ask for an explanation, so be prepared to explain why any conflicts arise and why you might choose one project over the other. Graph the projects’ NPV profiles and use this graph in your explanation.

d. In general terms, what would be included in a project’s required investment? Its terminal year cash flows? What is the required investment and terminal year cash flow for the HSD project, and what cash flows are included in each? Discuss the use of different terminal cash flow calculations and determine which makes the most sense in this case.

e. Given the data in Table IC11-1, find HSD’s annual euro free cash flows, and then calculate its NPV, IRR, and payback. On the basis of your project analysis, should the project be accepted if it is to be produced in Italy?

f. Suppose that a year ago MRI performed a feasibility study for the HSD project. The cost of this study was $100,000, and it was expensed for tax purposes last year. Describe in words how this would be incorporated in your capital budgeting analysis.

g. Suppose instead of having to build an entire new plant MRI could renovate an existing plant that currently lies idle. The cost of the renovation would be $20,000,000. Describe in words how this would be incorporated in your capital budgeting analysis.

h. A serious problem of locating production in other countries is the inability to repatriate funds back to the parent. In the current situation, MRI is considering production in Italy so this is not a problem; however, suppose that MRI was considering production in a country where repatriation of funds is limited. Explain in words how you would incorporate this in your capital budgeting analysis. (No numbers are needed here.)

i. In the Italian capital budgeting analysis, it was assumed that the exchange rate stayed constant throughout the project’s life. Obviously, this is an unrealistic assumption. Describe in words how you would incorporate a fluctuating exchange rate in your capital budgeting analysis.

j. Analyze the project from the parent perspective. What kind of dividend can the Italian subsidiary send back to MRI? What are the total free cash flows the parent expects, and what are the NPV, IRR, and payback of the project from the parent’s perspective? If MRI can purchase OPIC insurance, what effect does that have on project NPV and IRR?

k. Discuss the country perspective analysis developed in Table IC11-2. What are three important uses for this type of analysis?