Chapter 15

International Capital Budgeting

On January 10, 2010, the 186-year-old British candy company, Cadbury, agreed to be taken over by the American company, Kraft Foods, for $19 billion. How did Kraft determine that this was the right amount to pay? Why did Cadbury accept the offer? Answering these questions requires a methodology to value Cadbury with or without the merger. This chapter explains how corporations assess such future profitability. Our methodology is **adjusted net present value (ANPV)** analysis. The ANPV methodology can be used in **capital budgeting** when corporations make investment decisions and determine the valuations of international projects.

We also find the ANPV methodology particularly useful when valuing a project done by a foreign subsidiary. We use a multistep approach that begins with the discounted cash flows to the subsidiary and then makes the adjustments necessary to determine whether the project is worthwhile from the parent corporation's point of view. The first sections of this chapter describe why the ANPV approach provides correct international valuations. We then apply the ANPV approach to an extended case involving International Wood Products, Inc., a company that has seen a substantial increase in its exports to Europe and consequently must decide whether to locate a production subsidiary in Spain or expand its operations in New Hampshire.

15.1 An Overview of Adjusted Net Present Value

This section provides an overview of valuation done with adjusted net present value (ANPV) analysis. This is not the only way to do valuations or capital budgeting. Chapter 16 compares alternative methods, such as the weighted average cost of capital (WACC) method and the flow-to-equity (FTE) method. Although each method can be correctly applied to answer the same capital budgeting question, some methods are easier to apply in different situations. Our view is that the ANPV approach lends itself to international applications most easily.

The basic principal of capital budgeting is that all projects with positive ANPVs should be accepted. For mutually exclusive projects, the one with the highest ANPV should be undertaken. Modern financial theory develops the ANPV of a project in several steps, as discussed in the following sections.

Step 1: Discount the Cash Flows of the All-Equity Firm

The first step in deriving an ANPV is to calculate the net present value (NPV) of the project's cash flows under the hypothetical scenario in which the project is financed entirely with equity. Any benefits or costs associated with how the project is financed are valued at a later stage. Thus, in the first step, we are not concerned about the amount of debt issued to finance the project. The effects of the project on the firm's eventual capital structure or its debt–equity ratio are considered in later stages. At this point, we are only concerned that the value of the cash coming into the firm from the perspective of the firm's shareholders is greater than the value of the cash going out of the firm.

The project's all-equity NPV is the sum of all discounted expected future revenues minus the sum of current and discounted expected future costs and investments. The revenues and costs must be measured on an incremental, after-tax, cash flow basis. All cash flows should be measured in the same currency, and the discount rate must be appropriate for the currency of denomination of the cash flows.[1] The discount rates used for the all-equity NPV of the project should reflect both the time value of the money in which the forecasts are denominated and any risk premium that the firm's equity holders demand. Chapter 13 argues that a risk premium arises when the return on the project covaries with the return on a well-diversified international portfolio, in which case the cash flows from the project contain non-diversifiable risk.

Example 15.1 The Vincenzo Uno Project

Suppose that an Italian company, Vincenzo Uno, has a project with the following expected cash flows:

Annual revenue	€1,000,000
Annual cost	−€600,000
Operating income	€400,000
Corporate tax (0.34 tax rate)	−€136,000
After-tax profits	€264,000

If the discount rate for this project is 10%, the present value of these perpetual expected profits is as follows:[2]

$$\frac{€264{,}000}{1.10} + \frac{€264{,}000}{1.10^2} + \frac{€264{,}000}{1.10^3} + \ldots = \frac{€264{,}000}{0.10} = €2{,}640{,}000$$

Suppose that the initial investment required to generate these cash flows is €2,750,000. Then, the NPV of this project to Vincenzo Uno is negative:

$$€2{,}640{,}000 - €2{,}750{,}000 = -€110{,}000$$

Because the project has a negative NPV to the all-equity firm, it would not be undertaken unless additional benefits are available. Later examples in this chapter explore these benefits.

[1]Chapter 13 examines the choice of the discount rate for a project. Here we take the discount rate as given. Chapter 16 explores issues related to the currency of denomination of the forecasts.
[2]Perpetuity formulas are discussed in the appendix to this chapter.

Step 2: Add the Value of the Financial Side Effects

The second part of an ANPV analysis adds the **net present value of financial side effects (NPVF)** that arise from accepting the project. Generally, these effects arise from the following:

- The costs of issuing securities
- Tax deductions associated with the type of financing instrument used (including the tax deductibility of interest paid on debt)
- The costs of financial distress
- Subsidized financing from governments

These financial side effects are discussed in more detail later in the chapter.

Step 3: Value Any Real Options

The third part of an ANPV analysis adds the present value of any **real options (RO)** that arise from doing the project. Real options involve the ability to adjust the scale of the project in response to future information, such as closing a gold mine if the price of gold falls or scraping a factory if future demand is too low.

A special case of a real option is a **growth option**, which arises when a firm undertakes a project and obtains an option to do another project in the future. The option to do the second project adds value to the first project. The classic example of a growth option is the ability to do a sequel to a movie. After assessing the profitability of the first movie in a potential series, studio executives decide if it's worthwhile to make a sequel. Part of the benefit of doing the original movie comes in the form of an option to do the sequel only if the original is successful. These investment options are valuable and should be taken into account when deciding whether to do the first movie.

Although real options can be considered as part of the all-equity cash flows in step 1 of the ANPV, we break them out separately for two reasons. First, the value of such options is often difficult to quantify, and second, they are always positive and hence add value to the project. If the ANPV of the project is positive without adding the value associated with real options, the ANPV will only be *more* positive after considering the options.

In summary, the adjusted net present value (ANPV) of a project is the net present value (NPV) of the cash flows of a hypothetical, all-equity project, plus the net present value of financing side effects (NPVF), plus the present value of any real options (RO) that the project offers:

$$\text{ANPV} = \text{NPV} + \text{NPVF} + \text{RO} \tag{15.1}$$

The ANPV is the enterprise value of the project of the firm. The equity value is found by subtracting the value of debt from the ANPV.

Next, we examine the cash flows associated with each of the items in an ANPV in detail.

15.2 Deriving the NPV of Free Cash Flow

The first part of an ANPV analysis determines the discounted expected value of the project's future **free cash flows (FCF)**.[3] Free cash flow at time *t*, FCF(*t*), is the profit that is available for distribution to those who have supplied capital to the firm. The corporation

[3]This section provides only a limited overview of the link between accounting concepts and the determination of free cash flow. See Koller et al. (2005) for a reconciliation of the accounting statements of a corporation and the determinants of the corporation's free cash flow.

uses FCF to provide returns on the investments that various classes of investors have made in the firm.

FCF is defined to be the after-tax, incremental operating earnings from the project plus any non-cash accounting charges, such as **depreciation**, minus investments that the firm makes to produce future profit. These investments are of two types: increases in the firm's capital expenditures and increases in the firm's net working capital. **Capital expenditures** increase or replace the firm's property, plant, and equipment. The firm's **net working capital** is the cash, inventory, and net short-term assets that the firm must have to run its business. Both of these investments are discussed in more detail shortly.

The firm's managers decide what to do with the firm's FCF. If the firm is all-equity financed, FCF can be used in three ways: It can be paid out immediately to stockholders as dividends, it can be used to repurchase shares, or it can be retained in the firm. If the managers choose to retain the FCF, they can plan to pay the future value of today's FCF to shareholders as future dividends or as a **liquidating dividend**. A liquidating dividend is the value of final cash that the owners of a firm receive when it goes out of business. Alternatively, the managers can use the accumulated free cash flow to finance future projects.

As long as the firm earns an appropriate rate of return on its retained free cash flow, the firm need not pay out the FCF to the shareholders when it is realized. But if the management of the firm chooses not to pay out the FCF, it may develop excess cash, called **financial slack**. Firms with financial slack are often poorly managed and have high agency costs. **Agency costs** arise when managers do not have an incentive to act in the interests of shareholders. With too much financial slack, managers are tempted to spend the extra money on negative NPV projects or perks for themselves, such as larger offices or company jets. Financial slack can also reduce managers' incentives to find ways to make the company operate more cost-effectively. If the firm has issued debt, the FCF can be used to pay the interest and principal on the debt.[4] Remember, though, that the first part of an ANPV analysis ignores debt and its associated interest payments, the side effects of which will be introduced later in the chapter.

Incremental Profit

As we noted earlier, free cash flow represents the **incremental profit** of the project. When we make an investment, we are interested in how much new cash is coming into the firm in return. Focusing on incremental cash flows is important because changing how an international corporation operates can cannibalize some of the firm's existing business. For example, when the German car manufacturer BMW decided to build a U.S. manufacturing facility in the Greenville-Spartanburg area of South Carolina, the investment was worthwhile only if the discounted expected profits from producing and selling cars in the United States were larger than both the cost of constructing the new plant and the possible lost profits on export sales from Germany to the United States. If BMW thought it could export the cars that it was formerly exporting to the United States to another country, all the production from the company's new U.S. plant would have been considered incremental. In this case, the discounted expected profitability of the proposed U.S. plant would have been the only factor influencing the decision. On the other hand, if BMW thought that it would not be able to find a new market for the cars it was formerly exporting to the United States, the lost profit on these exports would have been a cost of establishing the new U.S. plant. This latter situation describes **export cannibalization**.

[4]See Jensen (1986) for a discussion of the use of debt in mergers and acquisitions. Jensen argues that debt disciplines the management by providing incentives to find efficiencies in generating operating cash flow that allows the debt to be repaid.

Exhibit 15.1 Deriving Free Cash Flow

Step 1.	Subtract costs from revenues:
	Revenue − Costs = Earnings before interest and taxes (EBIT)
Step 2.	Subtract taxes on earnings:
	EBIT − Taxes on EBIT = Net operating profit less adjusted taxes (NOPLAT)
Step 3.	Add back non-cash costs:
	NOPLAT + Accounting depreciation = Gross cash flow (GCF)
Step 4.	Subtract investments made to increase future profitability:
	GCF − Change in net working capital (ΔNWC) − Capital expenditures (CAPX) = Free cash flow (FCF)

Because forecasting free cash flow is separable from discounting it, we first consider each forecasting step in detail before discussing discounting. At this point, we consider all flows to be denominated in the same currency, which involves forecasting exchange rates. The steps needed to forecast free cash flow are summarized in Exhibit 15.1.

Deriving Free Cash Flow

Revenues and Costs

Forecasts of revenue, the price of a product times the amount sold, depend on the corporation's economic environment. Demand for the product depends on the company's pricing and advertising policies, on the competitive nature of its industry, and on macroeconomic factors in the countries where the company's sales occur. Future exchange rates will affect the value of the firm's future revenues. Exporters will be helped by depreciation of the home currency, and import competitors will be hurt by appreciation of the home currency.

The costs of operating a project include the costs of raw materials and labor, which are measured as the costs of goods sold (CGS). The managerial expenses, advertising, and other fixed costs of the project must also be subtracted. These are measured by the selling and general administrative expenses (SGA) of running the business. The final cost that must be subtracted is the accounting cost, measured by depreciation expense. Each of these costs is subtracted from revenues when calculating earnings.

If a firm imports raw materials or intermediate parts, its costs depend on exchange rates. A depreciation of the home currency drives up the cost of imports. Forecasting future costs involves understanding how wages and the prices of inputs will evolve in the economy in which the firm is manufacturing and how much it will cost to distribute the product around the world. It also involves understanding how any productivity-enhancing investments will affect the firm's future costs.

EBIT and NOPLAT

The pretax operating income that a firm would have if it had no debt is its **earnings before interest and taxes (EBIT)**:

$$\text{EBIT} = \text{Revenue} - \text{Cost of goods sold (CGS)} - \text{Selling and general administrative expenses (SGA)} - \text{Accounting depreciation}$$

Interest expense is not deducted from EBIT because we are valuing the project as if it has no debt in its capital structure. Because interest expense is a cost in most countries' accounting systems, however, one has to be careful to construct EBIT correctly from the firm's accounting statements. EBIT is found by adding taxes paid and interest to the after-tax income on the income statement.

After EBIT is calculated, we subtract the cash value of taxes that would actually be paid on EBIT to find an after-tax value of net operating profit. **Net operating profit less adjusted taxes (NOPLAT)** equals EBIT minus the taxes that would be paid on EBIT:

$$\text{NOPLAT} = \text{EBIT} - \text{Taxes on EBIT}$$

In practice, calculating the taxes on EBIT from actual income statements involves adding back the taxes the firm did not have to pay because it deducted interest expenses, subtracting any taxes on interest income that the firm earned, and subtracting any taxes incurred on non-operating income. (The value of "tax shields" arising from the ability to deduct interest payments on debt is discussed in Section 15.3.)

Free Cash Flow

After NOPLAT is derived, free cash flow is only a few short steps away. Because depreciation is an accounting expense, but not an actual cash flow, we must add depreciation to NOPLAT to generate gross cash flows:

$$\text{Gross cash flow (GCF)} = \text{NOPLAT} + \text{Accounting depreciation}$$

To go from gross cash flow to free cash flow involves subtracting two types of investments. We first subtract capital expenditures (CAPX), which are the firm's purchases of additional property, plant, or equipment that are required to do the project.

CAPX is typically large in the initial stages of the project. Eventually, the planned capital expenditures in future years will merely be whatever is necessary to maintain the plant and equipment by replacing what is wearing out, which we refer to as *economic depreciation*. In many presentations of valuations, it is assumed for the later stages of a project that CAPX equals depreciation. One must be careful, though, because there may be a big difference between accounting depreciation, which is related to the book value of the firm, and the actual economic depreciation that future CAPX represents. If CAPX is replacing the existing plant and equipment as it wears out, and if there is inflation, the nominal value of CAPX will differ from the depreciation recorded on the firm's books.

The second investment that must be subtracted from GCF to obtain FCF is changes in net working capital (NWC).[5] If the project involves expected additions to NWC, these investments will use cash and must be subtracted from GCF. Thus, free cash flow is

$$\text{FCF} = \text{GCF} - \text{CAPX} - \Delta\text{NWC}$$

Discounting Free Cash Flows

Because expected free cash flows are future values, we must discount them to determine their present value. Let the discount rate that is appropriate for the riskiness of the all-equity future cash flows be denoted r. Then, if the initial capital expenditures associated with the project are included in the initial year's free cash flow, the NPV of the project, on an all-equity basis, is

$$\text{NPV}(t) = \sum_{k=0}^{\infty} \frac{E_t[\text{FCF}(t+k)]}{(1 + r)^k} \qquad \textbf{(15.2)}$$

Although the discount rate in Equation (15.2) is assumed to be constant, in general, the discount rate is not required to be the same for each period in the future. The appropriate discount rate for each future period can be different. In this case, we can denote the rate that is appropriate for discounting expected time $t+k$ cash flows to time t as $r(t, k)$.

[5]Management of net working capital is reviewed in Chapter 19, where we more formally discuss the idea that increases in net working capital are investments that a firm is making in its future profitability.

Different discount rates can reflect differences in the time value of money for different periods in the future. The importance of this adjustment to Equation (15.2) will be demonstrated in the Consolidated Machine Tool Company capital budgeting case that is considered in Chapter 16.

Calculating the Terminal Value of a Project

The summation of discounted expected free cash flows in Equation (15.2) goes into the indefinite future because we think of the equity of a firm as being infinitely lived. Because our ability to forecast is limited, after developing explicit forecasts for a few years in the future, we are forced to assume that expected free cash flow will settle down, either to a constant value or, more typically, to growth at some constant rate such as the expected rate of inflation. Thus, after the explicit forecasting period, we calculate a **terminal value** for the project that represents the discounted present value of expected future free cash flows in the years extending into the indefinite future beyond the explicit forecast period using perpetuity formulas because we are assuming constant growth.

Suppose that we develop explicit forecasts for the next 10 years. Let the final explicit forecast of free cash flow at time t for 10 years in the future be $E_t[\text{FCF}(t+10)]$. Let's assume that future free cash flow grows at the rate g, and let the discount rate for these perpetual cash flows be r.[6] The starting value in year 11 is higher than the expected free cash flow in year 10 by $(1 + g)$. From the perpetuity formula for a growing cash flow, we know that

$$\text{Terminal value in year 10} = \frac{E_t[\text{FCF}(t+10)](1 + g)}{(r - g)}$$

After calculating the terminal value in year 10, we discount it to year 0 by dividing by $(1 + r)^{10}$:

$$\text{Terminal value in year 0} = \frac{\text{Terminal value in year 10}}{(1 + r)^{10}}$$

The growth rate of g should primarily reflect the expected rate of inflation in the currency of the forecasts because the project's real capacity will eventually be met. Additional real investments will have to be made to produce additional real goods. If there is a forecast of real growth without such additional investments, it would be under the assumption that the firm will be able to maintain its market share and its profitability as the world economy grows by installing replacement capital that is more productive than the old capital. If no new capital expenditures are planned and CAPX is just offsetting depreciation, the physical plant and equipment will not be capable of growing indefinitely unless the replacement CAPX is more productive. It makes sense to limit the assumed growth to the rate of inflation unless you are sure that the firm can install more efficient capital as old capital is replaced. If there is real growth and the forecast of real growth rate is 2%, with a forecast of inflation of 4%, we would forecast that free cash flow would grow at 6.08%, because

$$(1 + 2\%) \times (1 + 4\%) = (1 + 6.08\%)$$

Another way of determining the terminal value involves understanding when the firm's return on investment is expected to settle down to the competitive level predicted by the required rate of return that investors demand on capital employed by the firm. This approach to terminal values is discussed in Chapter 16.

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[6]The appendix to this chapter provides a derivation of the perpetuity formula used in deriving the terminal value.

15.3 Financial Side Effects

While the NPV of a project's free cash flow is usually the primary source of a project's value, it is not the only source. Side effects from financing the project can add significant value to the project. These financial side effects arise from the costs of issuing securities, from the tax deductions that certain types of financing provide, from the costs of financial distress associated with issuing debt, and from the subsidized financing that governments offer to entice corporations to locate in particular countries or regions. We discuss each of these issues in turn.

The Costs of Issuing Securities

When a corporation does not have enough resources from its current and previously generated free cash flows to finance a new project, it must turn to outside investors for additional resources. This process is costly for a number of reasons.

The investment bankers must be compensated for acting as financial intermediaries in issuing securities either to the public or to private investors. This compensation includes monetary fees, but it also includes an **underwriting discount**, or spread. The underwriting discount between what the corporation receives from issuing the securities and what the public pays for the securities is often a large part of the compensation of the investment bank that underwrites the issue.

Lee et al. (1996) investigated these costs as a function of the amount raised for initial public offerings (IPOs) of equity. They found that the percentage costs decrease as the amount of money raised increases, indicating that some economies of scale are achieved. Nonetheless, the costs are still large. According to the researchers, the flat expenses charged by underwriters averaged 3.69% of the amount raised, and gross spreads averaged 7.31% across the 1,767 IPOs studied.

Tax Shields for Certain Securities

When a firm issues debt, the interest paid on the debt is deductible for tax purposes because the government views interest as a legitimate cost of doing business. The value of the ability to deduct interest payments for tax purposes is called an **interest tax shield**. Because debt financing reduces a firm's income taxes, issuing debt increases the value of the corporation, at least for small amounts of debt.

To find the value of the interest tax shield, consider the following scenario. Suppose that the market interest rate on a one-period loan of principal D is r_D. Let the corporate income tax rate be τ. Then, in the first period, the corporation borrows D, and it repays $(1 + r_D)D$ in the second period. Because the interest payment is deductible, the corporation also gets a tax deduction of $\tau r_D D$ in the second period. The present value of these flows using the market interest rate as the discount rate is

$$D - \frac{(1 + r_D)D}{(1 + r_D)} + \frac{\tau r_D D}{(1 + r_D)} = \frac{\tau r_D D}{(1 + r_D)} \qquad (15.3)$$

Equation (15.3) demonstrates that the value of a loan at market interest rates is 0 in the absence of tax deductions or subsidies from the government. When interest is deductible, there is a valuable interest tax shield. If there were only benefits associated with issuing debt, the corporation would be entirely debt financed. Something else must be going on. We will examine the costs of debt later in this chapter, but first, we consider how adding debt to the capital structure of Vincenzo Uno's project changes its desirability.

Example 15.2 Vincenzo Uno's Tax Shield

Let's return to Example 15.1 and examine what happens if Vincenzo Uno issues some debt to finance the project. Suppose the company issues €500,000 of debt at 6% per annum. Also, assume that Vincenzo Uno will allow this debt to be outstanding for the indefinite future. The tax shield of $\tau r_D D$ derived in Equation (15.3) now occurs in every period into perpetuity. Hence, the discounted present value of the perpetual tax shield is

$$\frac{\tau r_D D}{(1 + r_D)} + \frac{\tau r_D D}{(1 + r_D)^2} + \frac{\tau r_D D}{(1 + r_D)^3} + \ldots = \tau D$$

With a corporate tax rate of 34%, the value of the tax shield is

$$0.34 \times €500{,}000 = €170{,}000$$

Because the net present value, assuming all-equity financing, was −€110,000, the value of the project is now positive, and Vincenzo Uno should do it by issuing both debt and equity.

The Discount Rate for Interest Tax Shields

The basic principle of ANPV analysis is that expected values of future cash flows should be discounted at the appropriate discount rate that reflects the riskiness of the cash flows. In Equation (15.3), we violated this procedure by discounting the promised cash flows with the actual market interest rate. We can reconcile the two approaches in the following way. Suppose that δ is the probability of default on the debt, and if the company defaults, it will pay nothing to its creditors. Then the expected payment is the probability-weighted average of the two possible payments:

$$(1 - \delta) \times (1 + r_D)D + \delta \times 0 = (1 - \delta) \times (1 + r_D)D$$

and the expected tax deduction for interest expense is

$$(1 - \delta) \times \tau r_D D + \delta \times 0 = (1 - \delta) \times \tau r_D D$$

Suppose that the events that will cause the firm to default are idiosyncratic to the firm. Then the appropriate discount rate for the expected debt cash flows is the risk-free interest rate, r_F. Thus, to find the value of a debt, the expected future values should be discounted at the risk-free rate. The value of a one-period debt is therefore

$$D - \frac{(1 - \delta)(1 + r_D)D}{(1 + r_F)} + \frac{(1 - \delta)\tau r_D D}{(1 + r_F)} \qquad (15.4)$$

The expression in Equation (15.4) reduces to the expression in Equation (15.3) when we recognize that the market sets the interest rate to reflect the probability of default:

$$(1 - \delta) \times (1 + r_D) + \delta \times 0 = (1 + r_F) \qquad (15.5)$$

Substituting from Equation (15.5) into Equation (15.4) gives Equation (15.3).

Costs of Financial Distress

The presence of interest tax shields suggests that a firm should be financed completely with debt because the bigger the debt, the larger is the tax shield. This cannot be right because we do not observe firms acting this way. Firms limit their leverage because **costs of financial distress** offset the benefits of the interest tax shields.

Direct Costs of Financial Distress

Financial distress arises when a firm has difficulty meeting its commitments to its bondholders. A firm defaults on its debts when it is unable or unwilling to make the required interest or principal payments on its debts. A bankruptcy proceeding may result, with the assets of the firm being formally transferred from the stockholders to the bondholders. Bankruptcy is costly because the legal, consulting, and accounting fees associated with the process eat away at the value of the company. Academic studies of the direct costs of financial distress find that they are typically around 3% of the market value of the firm.[7]

Indirect Costs of Financial Distress

The indirect costs of financial distress refer to the loss of a firm's value that occurs because people believe the company may fail in the future. For example, some potential customers will avoid a firm's product if they fear after-sales service will not be there. Suppliers will also be less willing to deal with the firm and may be unwilling to extend it credit, demanding that it pay cash for its purchases. This adversely affects the ability of the firm to manage its cash flow and increases the firm's required investments in its net working capital. Other indirect costs of financial distress occur on the managerial side of the business. The firm will have trouble attracting and retaining a high-quality, skilled labor force because no one will want to develop firm-specific human capital. Managers also might spend significant time looking for other jobs. These indirect costs of financial distress are more abstract and therefore more difficult to measure than direct costs.

The Equilibrium Amount of Debt

We know that a firm should issue debt up to the point at which the marginal benefit of the debt from the interest tax shield is equal to the marginal costs of financial distress. This is demonstrated in Exhibit 15.2. The marginal benefit of the debt is constant and is given by the tax shield. The marginal cost of debt is increasing. Initially, these costs are low, but eventually they escalate. To find the total benefits and total costs of issuing debt, we need to evaluate the areas under the marginal benefit and marginal cost curves.

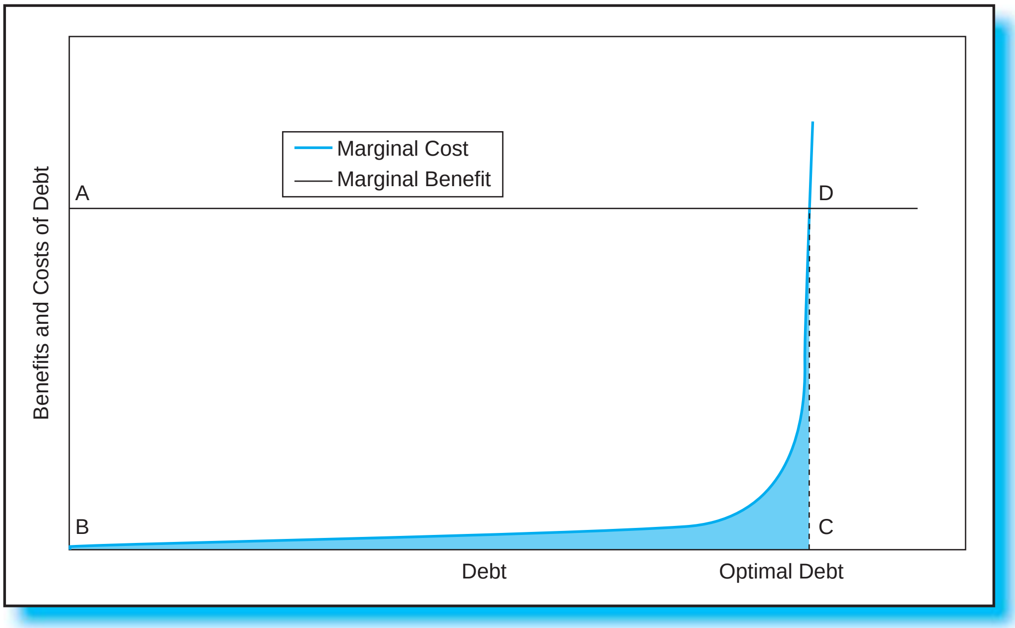
Exhibit 15.2 shows that the marginal cost of financial distress is essentially 0 when the firm first begins to take on debt, but it increases as the firm issues more debt. If the marginal cost of financial distress eventually increases quickly as the firm approaches its optimal capital structure, as in Exhibit 15.2, the total cost of financial distress, which is the area under the marginal cost curve, will be minimal and can essentially be ignored in valuing the firm. The value of issuing debt is then just the interest tax shield. Of course, it is always better to attempt to value the costs of financial distress by understanding how issuing debt adversely affects the ability of the firm to operate in world markets

Subsidized Financing

When a manufacturing company decides to build a plant in a foreign country, the company is often able to get regions of the country, or even entire countries, to compete for the jobs that will be brought to the area. The governments and municipalities of these countries and

[7]Some classic articles on the costs of bankruptcy include White (1983) and Altman (1984); for a more recent discussion, see Kalay et al. (2007).

Exhibit 15.2 The Benefits and Costs of Debt



Note: The rectangle ABCD is the total benefit of the debt. The shaded area under the marginal cost curve is the total cost of the debt.

regions will often offer subsidies to the corporation in the form of lower corporate taxes for a number of years. Alternatively, the subsidies might be loans made at below-market interest rates because such subsidies are less obvious to taxpayers.

Interest subsidies add value to a project. The appropriate discount rate for an interest subsidy is simply the market interest rate on the debt of the corporation. Why? Because the corporation is just as likely to default on a subsidized loan from the government as it is on a normal loan at market interest rates. Let's derive an analytical representation of the value of a subsidized loan. Suppose a corporation can borrow a principal of D for one period at a subsidized interest rate of $r_S < r_D$, which, as before, is the market interest rate on the corporation's debt. The corporation repays $(1 + r_S)D$ and gets the interest tax shield of $\tau r_S D$ in the second period. The present value of the cash flows of the subsidized debt using the market interest rate on the corporation's debt is therefore

$$D - \frac{(1 + r_S)D}{(1 + r_D)} + \frac{\tau r_S D}{(1 + r_D)} = \frac{(r_D - r_S)D}{(1 + r_D)} + \frac{\tau r_S D}{(1 + r_D)} \qquad (15.6)$$

Equation (15.6) demonstrates that the value of a subsidized loan is the present value of the interest subsidy, which is the difference between the interest paid on a market loan and the interest on the subsidized loan, plus the present value of the actual interest tax shield. In both cases, the present value is taken at the corporation's market interest rate.

15.4 Real Options

As noted in Section 15.1, real options also add value. A good example of how real options add value to international investments was a 1989 decision by Procter & Gamble (P&G) to purchase Phebo, a privately held Brazilian company. At the time, Phebo was the 13th-largest

Brazilian cleaning and personal care products company (see Procter & Gamble, 1991), and P&G was not operating in Brazil. In valuing Phebo, P&G used projected future free cash flows for Phebo's products under P&G management. P&G's discounted cash flow analysis indicated that a price of $91 million was appropriate for Phebo. P&G also recognized that there was significant option value from owning and operating Phebo. The idea was that P&G would learn about operating in Brazil and would be able to expand its presence in Brazil if the Phebo acquisition went well and the Brazilian economy improved.[8] Let's examine how a real option can affect the valuation of Vincenzo Uno, which we introduced in Example 15.1.

Example 15.3 Vincenzo Uno's Abandonment Option

Suppose Vincenzo Uno forecasts that it will either generate €1,250,000 or €750,000 in sales in its first year of operation and that the sales levels are equally likely. After the first year, though, the managers of the company will know for sure which of the two sales levels will persist into the indefinite future. Also, assume that the managers have an option to abandon the project if first-year sales are only €750,000. Finally, assume that the scrap value of the plant and equipment will be €1,425,000.

What should Vincenzo Uno do, given the two different sales scenarios? We summarize the situation with the following table that indicates cash flows in year 1 and in all future years if the project is abandoned in the bad state:

	Year 1		Future Years	
	Good State	**Bad State**	**Good State**	**Bad State**
Annual cash inflows	€1,250,000	€750,000	€1,250,000	0
Annual cash costs	−€600,000	−€600,000	−€600,000	0
Operating income	€650,000	€150,000	€650,000	0
Corporate tax (0.34 tax rate)	−€221,000	−€51,000	−€221,000	0
Unlevered free cash flow	€429,000	€99,000	€429,000	0

Thus, in 1 year, the project will have either of two values. In the good state, the project will be worth that year's free cash flow plus the value of the perpetuity from continuing in the good state, or

$$€429{,}000 + €429{,}000/0.10 = €4{,}719{,}000$$

On the other hand, in the bad state, the project will be abandoned and will be worth that year's free cash flow plus the scrap value of the machinery, or

$$€99{,}000 + €1{,}425{,}000 = €1{,}524{,}000$$

Because these valuations are equally likely, the discounted expected value of the project is

$$[0.5(€4{,}719{,}000) + 0.5(€1{,}524{,}000)]/1.10 = €2{,}837{,}727$$

[8] An additional source of value to the project arose from the fact that part of the investment was done with a debt-equity swap. P&G purchased Brazilian government dollar-denominated debt in the secondary market that was trading at a significant discount, presented the debt to the Brazilian government, and received in value more cruzeiros than could have been obtained by purchasing cruzeiros with those dollars at the market exchange rate. Countries do such swaps to encourage foreign direct investment.

Because this is more than the cost of the project, which is €2,750,000, Vincenzo Uno would undertake the project even without the benefits of debt.

Notice that in the first year, the value of doing the project in the bad state in perpetuity is the discounted value of receiving €99,000 in all future periods, or

$$€99{,}000/0.1 = €990{,}000$$

Thus, the abandonment option increases the value of the project in year 1 in the bad state by €1,425,000 − €990,000 = €435,000. Because there is a 50% chance of this happening, the value of the project increases by

$$[0.5(€435{,}000)]/1.10 = €197{,}727$$

This is the difference between the value of the project with the abandonment option, which is €2,837,727, and the value of the project without the abandonment option, which is €2,640,000, as in Example 15.1.

Problems with the Discounted Cash Flow Approach

The previous section shows that management's real options are important when doing project valuation. The problem with discounted cash flow analysis is that it usually ignores these options. As a result, projects tend to be undervalued. This problem exists whenever a manager can take a discretionary action in the future that affects the cash flows of a project. The ANPV approach adds in the value of real options as a separate valuation term.

Within an international context, perhaps the most important option involves the decision to enter a foreign market. Many factors need to be considered, such as changing costs and prices, changing real exchange rates, and the timing of the market entry. Similarly, the decision to exit the foreign market involves costs and depends on the real exchange rate. One important aspect of market entry is the competition: Does the competition also have the option of entering the same market? There is often a first-mover advantage related to establishing a product in a new market. In such a situation, the value of a firm's option to wait to enter can be competed away (see Grenadier, 2002). Option pricing can help value projects, given these situations.

Point–Counterpoint

Valuing a Project Using Discounted Cash Flows Versus a Ratio Analysis

Freedy is poring over the income statement of German firm Bayer, trying to develop a spreadsheet model of the discounted free cash flows of the company. He has a meeting with Ante in a few minutes, and he is trying to justify an investment by the Handel Brothers Trust Fund in the American depositary receipt of Bayer, which is listed on the NYSE. Ante asked him to find three or four undervalued equities that would make good investments. For Freedy, the equity value of a firm is found by subtracting the value of its debt from the enterprise value of the firm, which is the present discounted value of the firm's all-equity free cash flow plus any adjustments for debt and growth options. He thinks an undervalued equity has stock market value less than this predicted equity value. He also knows Ante doesn't necessarily do valuations this way.

Suddenly, Ante bursts into the room, sees Freedy's spreadsheets, and shouts, "What are you doing? I only wanted some sensible **ratio analysis**. Discounted free cash flow analysis never works. The valuations always depend on bogus assumptions about the terminal value. On Wall Street, they just check the **price–earnings (P/E) ratio**, and they buy low P/E stocks and sell high P/E stocks. You'll never make an investment if you stick to that discounted cash flow stuff."

Freedy, feeling a bit overwhelmed by his brother's tirade, meekly responds, "Well, I'm a value investor. When I invest, I want to see expected future profits discounted at some sensible required rate of return and know that I'm not paying too much for a stock. Think about all the people who got burned investing in dot-coms in 2000. The managers of those firms would explain to investors that they had 'good ratios' of stock prices to future earnings, but nobody at those firms even had a plan for becoming profitable. It was all a bubble. Ratio analysis is simply stupid."

As Suttle Trooth is walking by, he hears the brothers arguing and asks, "What's all the fuss about?" Both brothers talk at once, and Suttle realizes what's up. He says, "Well, I like doing a discounted cash flow analysis in some situations and a ratio analysis in others. Let's think about the relationship between them. We know that in a rational world, the stock price reflects the discounted expected payoffs to the stockholders. In fact, we know that higher P/E ratios are produced either by faster growth or lower required rates of return on the equity.

"A discounted cash flow analysis is a scientific tool," says Suttle, "but you've got to have the right forecasts to go into the tool. Otherwise, you'll get a garbage-in, garbage-out result. You've really got to understand the sources of a firm's profitability. Does a firm's production process give it a cost advantage that is sustainable? Are there barriers to entry in the market that significantly affect the firm's competitive situation? Have its marketing campaigns generated loyal customers? Is its accounting accurate and an honest reflection of reality? What do we think of the quality of the firm's management team? These are some of the forces that determine profitability, both now and in the future."

"Lots of times," continues Suttle, "analysts become comfortable with the nature of an industry and realize that its firms are all trading at prices around a certain multiple of some measure of current or projected future earnings. The analysts can then make their suggested trades based on P/E ratios, and they can be fairly sure that in the short run, they're in the right ballpark. Nevertheless, ratio analysis is just a quick, summary statistic. It's still necessary to do the due diligence of free cash flow analysis to really value a company."

The brothers looked at each other and smiled. Suttle was on target once again.

15.5 Parent Versus Subsidiary Cash Flows

The cash flows from a foreign subsidiary can differ substantially from the cash flows that can ultimately accrue to the parent. Consequently, we must be clear about whose ANPV we are evaluating. The fundamental point of free cash flow analysis is to determine the net present value of the cash that is available for distribution to the ultimate shareholders of the corporation. Hence, the parent's perspective is the most relevant for our analysis. If taxes, regulations, and foreign exchange controls severely limit the amount of funds that can be transferred from the foreign subsidiary to the parent, the project is less valuable than if it were being done by an independent company that owned the project inside the country.

Of course, the parent's free cash flows from a foreign subsidiary can also substantially exceed the subsidiary's free cash flow because of **royalty payments**, **licensing agreements**, and **overhead management fees**. Subsidiaries must pay these costs to the parent corporation. Hence, the subsidiary's income is reduced by these costs, but the parent's income is enhanced.

In addition, if the parent is selling intermediate parts to the subsidiary, the subsidiary's cost of goods sold includes the amount of profit that is included in the transfer pricing of the intermediate parts. Clearly, this profit enhances the value of the subsidiary from the parent company shareholder's perspective.

Although the parent's perspective is ultimately what we want to value, it is often easiest to do international capital budgeting with a three-step approach. We begin with the subsidiary's viewpoint of free cash flow and then consider how the cash flows change when the parent's viewpoint is taken into account. Finally, we adjust for financial side effects and growth options. We now consider these three steps in detail.

A Three-Step Approach to Determining the Value of a Foreign Subsidiary

The first step in deriving the value of a foreign subsidiary to the parent corporation involves conducting the NPV cash flow analysis of the foreign subsidiary as if it were an independent, all-equity firm. This analysis provides the value that an independent company would place on the foreign project if it were licensed to use the technology of the parent corporation. Hence, the royalty payments, licensing fees, and other overhead management fees that the subsidiary must pay the parent are just costs of doing business.

Second, we consider the cash flow implications from the parent's perspective. Several issues are important at this point. First, the dividends that the subsidiary will pay to the parent will incur withholding taxes because foreign governments tax the repatriation of profits. These taxes essentially reduce the value of the free cash flow that accrues to the parent relative to what accrues to the subsidiary by the percentage tax rate. From the parent's perspective, though, the after-tax values of the royalty payments, licensing fees, and management fees that the subsidiary pays the parent provide profits that increase the parent's valuation of the foreign subsidiary. We must also include any profits on sales of intermediate parts from the parent to the subsidiary. Finally, we must watch for cannibalization of exports to the market served by the subsidiary, as discussed in Section 15.2.

In the third step, we must adjust the value of the project for the net present value of financing side effects and possible growth options. Often, there will be loans and subsidies that must be valued. Opportunities for additional growth in the future will also typically be present. These three steps are now demonstrated in an extensive case analysis.

15.6 The Case of International Wood Products

International Wood Products, Inc. (IWPI) is considering whether to build a Spanish manufacturing facility to serve its European market. IWPI is U.S.–based and manufactures wooden tables and chairs. The stylishly designed furniture has found its way into better European homes, and the company forecasts that European demand for its furniture is likely to increase significantly over the next 10 years. IWPI is currently exporting to Europe from its New Hampshire manufacturing plant. Because European demand for the company's products has been growing at 10% per year for the past 5 years, the New Hampshire plant is now operating at 100% of capacity. Hence, this is an appropriate time for IWPI to consider establishing a new European production facility.

Although Spain is not centrally located in Europe, the availability of skilled Spanish workers at relatively low wages makes locating in Spain desirable. In addition, the Spanish government is offering a 10-year, €30 million loan at an attractive interest rate of 3% per annum. The interest payments on the loan would be due annually at the end of the year, and the repayment of principal would be a final payment at the end of year 10.

IWPI-Spain's Free Cash Flows

Initial Investments

IWPI's managers have discovered a manufacturing facility outside of Madrid, Spain, that can be acquired for €100 million. They estimate that the total cost of equipping the plant with the necessary machines would be €73 million. An initial investment in cash and inventory would require another €5.66 million. Hence, the total initial expenditure on the project is

$$€100 \text{ million} + €73 \text{ million} + €5.66 \text{ million} = €178.66 \text{ million}$$

At the spot exchange rate of \$1.40/€, the total initial dollar investment is therefore

$$€178.66 \text{ million} \times \$1.40/€ = \$250.12 \text{ million}$$

After the acquisition, training the Spanish workforce to meet IWPI's high quality standards will take time, and IWPI forecasts that only one-half of the first year's European demand will be met by the Spanish facility.

Forecasting Total Revenue

Exhibit 15.3 presents forecasts of revenue for the next 10 years for IWPI-Spain. Line 1 indicates that growth in European demand is expected to be 10% in the first year; to increase to 12% by the third year, as new showrooms are opened throughout Europe; and then to decline to 1% by year 10, as the market becomes saturated. Line 2 translates these growth forecasts into forecasts of unit sales. Because the current European demand for IWPI's furniture is 40,000 units, 10% growth in year 1 implies expected sales of 44,000 units. One-half of this, or 22,000 units, will be produced in Spain. Thereafter, IWPI plans to satisfy the entire European demand from the Spanish plant. By the 10th year, the Spanish plant expects to produce slightly more than 76,000 units. The Madrid facility is sufficiently large that this growth can be accommodated without a major expansion of plant and equipment.

The current dollar price of a typical unit of IWPI furniture is \$3,430, and IWPI charges an analogous euro price, which at the current exchange rate is

$$\$3{,}430/(\$1.40/€) = €2{,}450$$

Sales in the parts of Europe that do not use the euro will be priced in local currencies, but the retail prices will be dictated by the euro price. This retail price is expected to increase at the euro rate of inflation. The forecasts in Line 3 of Exhibit 15.3 indicate that IWPI expects the euro rate of inflation to first increase before falling to 2% from year 4 into the indefinite future.

Line 5 of Exhibit 15.3 forecasts euro revenue by multiplying the expected euro price per unit in Line 4 by the expected number of units sold in Line 2. Revenue forecasts increase from €55.52 million in the first year to €236.04 million in 10 years.

Exhibit 15.3 Revenue Forecasts for IWPI-Spain

	Year in the Future									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Real Growth Rates of Unit Sales	10%	11%	12%	10%	8%	6%	4%	3%	2%	1%
2. Unit Sales	22,000	48,840	54,701	60,171	64,985	68,884	71,639	73,788	75,264	76,017
3. Euro Inflation Rates	3%	4%	3%	2%	2%	2%	2%	2%	2%	2%
4. Euro Price per Unit	2,524	2,624	2,703	2,757	2,812	2,869	2,926	2,985	3,044	3,105
5. Total Euro Revenue (millions) (Line 2) × (Line 4)	55.52	128.18	147.87	165.91	182.76	197.60	209.62	220.22	229.12	236.04

Exhibit 15.4 Forecasts of Additions to Net Working Capital and Capital Expenditures for IWPI-Spain

	Year in the Future										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Total Revenue (Exhibit 15.3, Line 5)		55.52	128.18	147.87	165.91	182.76	197.60	209.62	220.22	229.12	236.04
2. Stock of NWC (year 0 given, then 10.5% of Line 1)	5.66	5.83	13.46	15.53	17.42	19.19	20.75	22.01	23.12	24.06	24.78
3. Addition to NWC (Line 2 year i − Line 2 year (i −1))		0.17	7.63	2.07	1.89	1.77	1.56	1.26	1.11	0.93	0.73
4. Capital Expenditures	173.00	10.58	11.01	11.34	11.56	11.80	12.03	12.27	12.52	12.77	13.02
5. Depreciation		10.28	10.90	11.56	12.23	12.92	13.62	14.33	15.06	15.81	16.57

Notes: All numbers are in millions of euros. Capital expenditures are the nominal spending necessary to keep the real capital stock constant.

Forecasting Net Working Capital, Capital Expenditures, and Depreciation

Exhibit 15.4 presents forecasts of investments that IWPI-Spain must make to maintain its productivity and satisfy the demand for its products. These investments are presented now because they determine accounting depreciation, which is a cost of doing business but not a cash outflow.

The first investment is net working capital, the cash and inventory that the firm needs to conduct its business. The initial stock of net working capital is €5.66 million, and we assume that net working capital is expected to be 10.5% of total revenue. Line 1 of Exhibit 15.4 presents the total revenue forecasts, and the required stocks of net working capital are in Line 2. The additions to net working capital are presented in Line 3 and represent the increases in the stocks from year to year. For example, 10.5% of the first year's total revenue is €5.83 million, which is greater than the initial €5.66 million. Hence, the first-year investment is

$$€5.83 \text{ million} - €5.66 \text{ million} = €0.17 \text{ million}$$

Line 4 of Exhibit 15.4 presents the forecasts of capital expenditures (CAPX). Annual nominal CAPX is required to offset economic depreciation, that is, the wearing out of plant and equipment. Management anticipates that economic depreciation as a percentage of the real capital stock will coincide with the percentage associated with accounting depreciation, derived below. But, as the plant and equipment wear out, the nominal euros that must be spent to keep the real capital stock constant increase with inflation.

The Spanish tax authorities require straight-line accounting depreciation with a 3% per year allowance for plant and 10% per year allowance for equipment. Because plant represents 58% (€100 million out of €173 million) of the initial CAPX and equipment represents 42% (€73 million out of €173 million), accounting depreciation in the first year is $(0.03 \times 0.58) + (0.10 \times 0.42) = 5.94\%$ of initial CAPX (€173 million), or €10.28 million. We assume that CAPX in year 1 is also 5.94% of initial CAPX, but 3% more must be spent due to inflation. Hence, CAPX in year 1 is €10.58 million. In later years, CAPX grows with the euro rate of inflation, $\pi(t+k, €)$, because purchasing the same 5.94% of the real plant and equipment gets progressively more expensive:

$$\text{CAPX}(t+k) = \text{CAPX}(t+k-1) \times (1 + \pi(t+k, €))$$

Line 5 of Exhibit 15.4 presents the forecasts of accounting depreciation, which are related to the forecasts of CAPX. Until the initial plant and equipment are fully depreciated, which will take 33 years for plant and 10 years for equipment, depreciation in year $t+k$ is the same as last year's depreciation plus 5.94% of last year's CAPX. Hence, depreciation follows

$$\text{Depreciation}(t+k) = \text{Depreciation}(t+k-1) + 0.0594 \times \text{CAPX}(t+k-1)$$

Forecasting Total Costs

Exhibit 15.5 forecasts total costs for IWPI-Spain, which include variable costs and fixed costs. Variable cost per unit has three components. Labor costs in Line 1.a begin at €702. Materials sourced in Europe, presented in Line 1.b, are forecast to cost €665 per unit in the first year. Intermediate parts sourced from the parent company, IWPI-U.S., are presented in Line 1.c and are forecast to cost €407 per unit in the first year. Labor costs, the price of European materials, and the euro price of U.S. parts are each forecast to increase at the euro rate of inflation. For imported parts, this assumption is consistent with the dollar prices of the parts being expected to increase at the dollar rate of inflation and the $/€ exchange rate being expected to satisfy relative purchasing power parity (see Chapter 8). Total variable cost in Line 2 represents the estimated number of units sold in a particular year (Line 2 of Exhibit 15.3) multiplied by the sum of the per-unit variable labor costs and the two material costs. Total variable cost is forecast to increase from €39.03 million in the first year to €165.93 million in 10 years.

The next part of Exhibit 15.5 forecasts the costs associated with the royalty and the overhead allocation agreements between IWPI-U.S. and IWPI-Spain. The royalty fee paid by IWPI-Spain to its parent, in Line 3, is 5% of total revenue. The overhead allocation fee paid to the parent corporation for accounting and other managerial assistance, in Line 4, is 2% of total revenue. Because these fees are constant percentages of total revenue, they grow with total revenue.

Fixed costs and direct overhead expenses of IWPI-Spain are presented in Line 5 of Exhibit 15.5. These begin at €1.59 million and increase at the euro rate of inflation. Depreciation, calculated in Exhibit 15.4, is the last cost and is presented again for completeness as Line 6.

Total cost in Line 7 of Exhibit 15.5 is the sum of total variable cost in Line 2, the royalty fee in Line 3, the overhead allocation fee in Line 4, the overhead expenses in Line 5, and depreciation in Line 6. Total costs are forecast to increase from €54.78 million in the first year to €200.98 million in 10 years.

Exhibit 15.5 Cost Forecasts for IWPI-Spain

	Year in the Future									
	1	2	3	4	5	6	7	8	9	10
1. Variable Cost per Unit										
a. Labor	702	730	752	767	782	798	814	830	847	864
b. Materials Sourced in Europe	665	692	712	727	741	756	771	786	802	818
c. Parts Purchased from IWPI-U.S.	407	423	436	445	454	463	472	481	491	501
2. Total Variable Cost (Lines 1.a + 1.b + 1.c) × (Exhibit 15.3, Line 2)	39.03	90.11	103.95	116.63	128.48	138.91	147.36	154.81	161.07	165.93
3. Royalty Fees @ 5% of Total Revenue (0.05 × Exhibit 15.3, Line 5)	2.78	6.41	7.39	8.30	9.14	9.88	10.48	11.01	11.46	11.80
4. Overhead Allocation @ 2% of Total Revenue (0.02 × Exhibit 15.3, Line 5)	1.11	2.56	2.96	3.32	3.66	3.95	4.19	4.40	4.58	4.72
5. Overhead Expenses	1.59	1.65	1.70	1.74	1.77	1.81	1.84	1.88	1.92	1.96
6. Depreciation (Exhibit 15.4, Line 5)	10.28	10.90	11.56	12.23	12.92	13.62	14.33	15.06	15.81	16.57
7. Total Cost (Lines 2 + 3 + 4 + 5 + 6)	54.78	111.64	127.56	142.21	155.96	168.17	178.21	187.17	194.83	200.98

Note: All numbers except the per-unit values in Line 1 are in millions of euros.

Exhibit 15.6 Forecasts of After-Tax Profit for IWPI-Spain

	Year in the Future									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Total Revenue (Exhibit 15.3, Line 5)	55.52	123.18	147.87	165.91	182.76	197.60	209.62	220.22	229.12	236.04
2. Total Cost (Exhibit 15.5, Line 7)	54.78	111.64	127.56	142.21	155.96	168.17	178.21	187.17	194.33	200.98
3. Earnings Before Interest and Tax (EBIT) (Line 1 − Line 2)	0.74	16.54	20.30	23.69	26.80	29.43	31.41	33.05	34.29	35.06
4. Corporate Income Tax @ 35% (0.35 × Line 3)	0.26	5.79	7.11	8.29	9.38	10.30	10.99	11.57	12.00	12.27
5. Earnings After Tax (NOPLAT) (Line 3 − Line 4)	0.48	10.75	13.20	15.40	17.42	19.13	20.41	21.48	22.29	22.79

Note: All numbers are in millions of euros.

Forecasting Net Operating Profit Less Adjusted Taxes (NOPLAT)

Exhibit 15.6 forecasts NOPLAT. Line 1 reproduces the forecasts of total revenues from Line 5 of Exhibit 15.3. Line 2 reproduces the forecasts of total costs from Line 7 of Exhibit 15.5. The difference between total revenue and total cost is earnings before interest and taxes (EBIT), which is presented in Line 3. With a Spanish corporate income tax rate of 35%, Line 4 gives corporate taxes as 35% of EBIT. Line 5 presents after-tax earnings or NOPLAT, which start at €0.48 million in the first year and increase to €22.79 million in 10 years.

Forecasting IWPI-Spain's Free Cash Flow

Exhibit 15.7 presents the forecasts of IWPI-Spain's free cash flow. The first line presents after-tax earnings (NOPLAT), derived in Line 5 of Exhibit 15.6. To NOPLAT we add the accounting depreciation in Line 6 of Exhibit 15.5 because accounting depreciation was subtracted as a cost, but it is not a cash flow. The firm's investments, the change in its net working capital and its capital expenditures, from Lines 3 and 4 of Exhibit 15.6, are then subtracted. The results in Line 5 of Exhibit 15.7 are the forecasts of free cash flow (FCF). The initial FCF is negative and represents the initial cost of the project. Forecasts of FCF start at zero in year 1 and grow to €25.60 million in year 10.

The Net Present Value of IWPI-Spain

The forecasts of free cash flow must then be discounted to the present. The discount rate reflects a 4.5% nominal interest rate on 10-year German government bonds (the risk-free euro interest rate), a beta for the project of 1.2, and an equity risk premium of 5.5%:

$$11.1\% = 4.5\% + (1.2 \times 5.5\%)$$

Hence, the discount factor for year k in the future is $1/(1 + 0.111)^k$, and these values are given in Line 6 of Exhibit 15.7. Multiplying these discount factors by the forecasts of free cash flow in Line 5 gives the present values of the free cash flows in Line 7. The sum of these present values plus the terminal value provides the net present value of the project.

Deriving the Terminal Value

The terminal value in Line 8 of Exhibit 15.7 represents the discounted present value of all expected future free cash flows in years 11 and beyond into the indefinite future. The year 0 value of the terminal value is calculated to be €100.17 million. This terminal value is calculated in two steps. First, the terminal value of free cash flow in year 10 is taken to be a perpetuity that is growing at the long-run euro rate of inflation of 2%. The perpetuity must

Exhibit 15.7 Net Present Value of Project Free Cash Flows for IWPI-Spain

	Year in the Future										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Earnings After Tax (NOPLAT) (Exhibit 15.6, Line 5)		0.48	10.75	13.20	15.40	17.42	19.13	20.41	21.48	22.29	22.79
2. Depreciation (Exhibit 15.4, Line 5)		10.28	10.90	11.56	12.23	12.92	13.62	14.33	15.06	15.81	16.57
3. Change in NWC (Exhibit 15.4, Line 3)	5.66	0.17	7.63	2.07	1.89	1.77	1.56	1.26	1.11	0.93	0.73
4. Capital Expenditures (CAPX) (Exhibit 15.4, Line 4)	173.00	10.58	11.01	11.34	11.56	11.80	12.03	12.27	12.52	12.77	13.02
5. Free Cash Flow (FCF) (Lines 1 + 2 − 3 − 4)	−178.66	0.00	3.02	11.35	14.17	16.77	19.16	21.21	22.91	24.39	25.60
6. Discount Factors (@ 11.1% per annum)	1.00	0.90	0.81	0.73	0.66	0.59	0.53	0.48	0.43	0.39	0.35
7. Present Value of FCF (Lines 5 × 6)	−178.66	0.00	2.45	8.28	9.30	9.91	10.19	10.15	9.87	9.46	8.94
8. Terminal Value	100.17										
9. NPV of the Project (sum of Line 7 + Line 8)	0.05										

Notes: All numbers except the discount factors are in millions of euros. The terminal value is the discounted value of free cash flow from years 11 to infinity, calculated as a perpetuity growing at the euro rate of inflation of 2%.

be discounted at 11.1%, and its starting value in year 11 will be 2% higher than the expected value of the free cash flow in year 10. That is, the terminal value in year 10 is

$$\frac{(\text{€}25.60 \text{ million}) \times (1 + 0.02)}{(0.111 - 0.02)} = \text{€}286.95 \text{ million}$$

Second, the terminal value in year 10 is discounted to year 0 by dividing by $(1 + 0.111)^{10}$:

$$\text{Terminal value in year 0} = \frac{\text{€}286.95 \text{ million}}{(1 + 0.111)^{10}} = \text{€}100.17 \text{ million}$$

Notice that IWPI forecasts 2% growth in free cash flow into the indefinite future, which is the expected euro rate of inflation. This reflects IWPI's assessment that the Spanish plant and equipment can only produce 76,000 units. Consequently, free cash flow cannot grow faster than inflation without additional investments.

The last line of Exhibit 15.7 adds the present values of the free cash flows in Line 7 and the terminal value in Line 8 to obtain an initial net present value of the project of €0.05 million. This is the value that an independent all-equity Spanish company that was licensed by IWPI would place on the cash flows coming from IWPI-Spain. Such a company would have a zero net present value project. The projected value of the free cash flows in years 1 to infinity would just be worth what the company would pay in the initial year.

The Parent Company's Perspective

This section considers how the value of a project changes when we take the perspective of the U.S. parent corporation. We first adjust for differences in taxes because the U.S. parent owes U.S. taxes on the dividends it receives, but it also receives some tax credits. More importantly, many items that were costs to the subsidiary provide profit to the parent. This additional profit substantially enhances the parent's value of the project. Throughout this section, we continue to present the analysis in euros, although we note that U.S. taxes must be paid in dollars.

Forecasting the Dividends Received by IWPI-U.S.

We assume that the dividends IWPI-Spain pays to its parent company, IWPI-U.S., will equal its annual free cash flow. The amount that IWPI-U.S. receives depends on both Spanish and U.S. tax laws. Exhibit 15.8 demonstrates that IWPI-U.S. initially receives 10% less than IWPI-Spain pays because the Spanish government imposes a 10% withholding tax on dividends paid by subsidiaries to their parent corporations.

Calculating the U.S. Foreign Tax Credit

Under U.S. tax law, IWPI-U.S. can claim a foreign tax credit for the withholding tax that is paid on the international dividends it receives. IWPI-U.S. also receives a tax credit for a portion of the Spanish income tax paid by IWPI-Spain. The portion of the Spanish tax that becomes a U.S. tax credit is determined by the deemed paid credit, which is discussed shortly. These tax credits help to offset the IWPI-U.S. income tax liability in the United States on the dividend income it receives from its Spanish subsidiary. Exhibit 15.9 presents the U.S. foreign tax credit, and Exhibit 15.10 derives the potential U.S. tax liability.

Exhibit 15.8 Dividends Received by IWPI-U.S.

	Year in the Future									
	1	2	3	4	5	6	7	8	9	10
1. Dividend Paid to IWPI-U.S. (Exhibit 15.7, Line 5)	0.00	3.02	11.35	14.17	16.77	19.16	21.21	22.91	24.39	25.60
2. Spanish Withholding Taxes @ 10% (0.10 × Line 1)	0.00	0.30	1.14	1.42	1.68	1.92	2.12	2.29	2.44	2.56
3. After-Tax Dividend Rec'd by IWPI-U.S. (Line 1 − Line 2)	0.00	2.72	10.22	12.76	15.09	17.24	19.09	20.62	21.95	23.04

Note: All numbers are in millions of euros.

Exhibit 15.9 Calculation of Foreign Tax Credit for IWPI-U.S.

	Year in the Future									
	1	2	3	4	5	6	7	8	9	10
1. Net Income to IWPI-Spain (Exhibit 15.6, Line 5)	0.48	10.75	13.20	15.40	17.42	19.13	20.41	21.48	22.29	22.79
2. Dividend Paid by IWPI-Spain (Exhibit 15.8, Line 1)	0.00	3.02	11.35	14.17	16.77	19.16	21.21	22.91	24.39	25.60
3. Income Tax Paid by IWPI-Spain (Exhibit 15.6, Line 4)	0.26	5.79	7.11	8.29	9.38	10.30	10.99	11.57	12.00	12.27
4. Deemed Paid Credit to IWPI-U.S. for Income Taxes Paid by IWPI-Spain [(Line 2 / Line 1) × Line 3] if Line 2 < Line 1; Line 3, otherwise	0.00	1.63	6.11	7.63	9.03	10.30	10.99	11.57	12.00	12.27
5. Withholding Tax Paid (Exhibit 15.8, Line 2)	0.00	0.30	1.14	1.42	1.68	1.92	2.12	2.29	2.44	2.56
6. Total Foreign Tax Credit (Line 4 + Line 5)	0.00	1.93	7.25	9.05	10.71	12.22	13.11	13.86	14.44	14.83

Note: All numbers are in millions of euros.

Exhibit 15.10 Calculation of U.S. Tax Liability of IWPI-U.S.

	Year in the Future									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Grossed-up Foreign Dividend Received (Exhibit 15.8, Line 3 + Exhibit 15.9, Line 6)	0.00	4.64	17.46	21.81	25.80	29.46	32.21	34.48	36.39	37.88
2. Tentative U.S. Tax Liability @ 34% (0.34 × Line 1)	0.00	1.58	5.94	7.41	8.77	10.02	10.95	11.72	12.37	12.88
3. Available Foreign Tax Credit (Exhibit 15.9, Line 6)	0.00	1.93	7.25	9.05	10.71	12.22	13.11	13.86	14.44	14.83
4. Net U.S. Tax Owed (Line 2 − Line 3, if Line 2 > Line 3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Excess Foreign Tax Credit (Line 3 − Line 2, if Line 2 < Line 3)	0.00	0.35	1.31	1.64	1.94	2.20	2.16	2.13	2.07	1.95

Note: All numbers are in millions of euros.

The most important part of Exhibit 15.9 is the calculation of the **deemed-paid credit** in Line 4. If the ratio of the dividend paid by IWPI-Spain to its after-tax income is less than 1, only that corresponding fraction of the income tax paid by IWPI-Spain is allowed as a credit against U.S. taxes owed by IWPI-U.S. For example, Line 1 of Exhibit 15.9 shows that the year 2 forecast of after-tax income (NOPLAT) of IWPI-Spain is €10.75 million. Because of its investments in CAPX and the change in net working capital that must be made in that year, IWPI-Spain will not pay its full after-tax income as a dividend. In Line 2 of Exhibit 15.9, we see that the year 2 forecast of IWPI-Spain's free cash flow is €3.02 million, and this amount will be paid to the parent as a dividend. Consequently, even though IWPI-Spain expects to pay €5.79 million in Spanish income taxes, only €1.63 million is allowed as a U.S. foreign tax credit because this is the same proportion of the income tax as the income paid by IWPI-Spain to its parent as a dividend:

$$\frac{\text{Dividend of €3.02 million}}{\text{Net income of €10.75 million}} \times \text{Spanish tax of €5.79 million} = \text{Credit of €1.63 million}$$

The reason that only €1.63 million of the Spanish income tax of €5.79 million is allowed as a foreign tax credit is that the U.S. government recognizes that only that fraction of the income of the foreign subsidiary was paid to the parent. After year 5, the dividend paid is forecast to be larger than the subsidiary's net income because of increases in depreciation relative to CAPX, so the full Spanish tax is credited. The sum of the deemed-paid credit (Line 4) and the dividend withholding tax (Line 5) gives the foreign tax credit in Line 6 of Exhibit 15.9.

Calculating the U.S. Income Tax Liability for IWPI-U.S.

Exhibit 15.10 calculates whether IWPI-U.S. will owe additional U.S. income tax on the dividends it receives from IWPI-Spain or whether there will be excess foreign tax credits that can be used to offset the U.S. income tax IWPI-U.S. owes on other foreign income. Line 1 presents the **grossed-up dividend**, which is the sum of the actual dividend received (Exhibit 15.8, Line 3) plus the foreign tax credit (Exhibit 15.9, Line 6).

In year 2, the dividend received after paying the Spanish withholding tax is €2.72 million. The foreign tax credit in year 2 is €1.93 million. Hence, for U.S. tax purposes, the grossed-up dividend is €2.72 million + €1.93 million = €4.65 million. Because the U.S. corporate income tax rate is 34%, the U.S. corporate income tax on this amount would be

$$0.34 \times \text{€4.65 million} = \text{€1.58 million}$$

If the tentative U.S. tax liability is less than the available foreign tax credit, calculated in Exhibit 15.9 and presented in Line 3 of Exhibit 15.10, then no additional U.S. tax is owed. This analysis is evaluated in Line 4. Line 5 of Exhibit 15.10 subtracts the U.S. tax liability from the available foreign tax credit to calculate the excess foreign tax credit. These excess foreign tax credits can be used by IWPI-U.S. to offset U.S. income taxes owed on other foreign income.

Calculating the Net Present Value of After-Tax Dividends Received by IWPI-U.S.

Now, we can calculate the after-tax value of the dividends received by IWPI-U.S. In Exhibit 15.11 the present value of after-tax dividends received by IWPI-U.S. is €160.84 million. This present value includes a terminal value, calculated as a perpetuity, growing at 2% and discounted at 11.1%:

$$€90.15 \text{ million} = \frac{€23.04 \text{ million} \times 1.02}{(0.111 - 0.02) \times (1.111)^{10}}$$

Because the present value of the dividends is less than the €178.66 million total cost of the project, if dividends were the only source of value, the NPV of the project would be negative, and it would not be undertaken. But, there are additional sources of value. IWPI-U.S. receives royalties and overhead allocation fees that add value to the project.

Forecasting the Royalty and Overhead Allocation Fees

The royalty fee in Line 1 of Exhibit 15.12 is forecast to be 5% of total revenue, which was calculated in Exhibit 15.3. The Spanish government extracts a 10% withholding tax on royalty payments, in Line 2, in recognition of the fact that the royalty payment is income to the parent, exactly like a dividend. The overhead allocation fee in Line 3 of Exhibit 15.12 is also a cost to the subsidiary and a profit to the parent. It is forecast to be 2% of total revenue, and the Spanish government extracts a 14% withholding tax on such payments, as is calculated in Line 4. Line 5 of Exhibit 15.12 sums the after-withholding-tax values of the royalty and overhead fees, which provide forecasts of income to IWPI-U.S. The tentative U.S. corporate tax liability of 34% is calculated in Line 6, based on the gross of foreign tax royalties and fees received, because the U.S. government gives a tax credit for the Spanish withholding taxes. Line 7 presents the excess foreign tax credit that is available from Exhibit 15.10. The net U.S. tax owed is calculated in Line 8. IWPI receives a tax credit for the two withholding taxes and can use the excess foreign tax credit from its dividends.

Exhibit 15.11 Net Present Value of After-Tax Dividends for IWPI-U.S.

	Year in the Future										
	0	1	2	3	4	5	6	7	8	9	10
1. After Tax Value of Dividends to IWPI-U.S. (Exhibit 15.8, Line 3 − Exhibit 15.10, Line 4)		0.00	2.72	10.22	12.76	15.09	17.24	19.09	20.62	21.95	23.04
2. Discount Factors (@ 11.1% per annum)	1.00	0.90	0.81	0.73	0.66	0.59	0.53	0.48	0.43	0.39	0.35
3. Present Value of After-Tax Dividends (Line 1 × Line 2)		0.00	2.20	7.45	8.37	8.92	9.17	9.14	8.88	8.51	8.04
4. Terminal Value of Dividends	90.15										
5. NPV of After-Tax Dividends (sum of Line 3 + Line 4)	160.84										

Notes: All numbers except the discount factors are in millions of euros. The terminal value is the discounted value of dividends from years 11 to infinity, calculated as a perpetuity growing at the euro rate of inflation of 2%.

Exhibit 15.12 Net Present Value of After-Tax Royalty and Overhead Allocation Fees Received by IWPI-U.S.

	Year in the Future										
	0	1	2	3	4	5	6	7	8	9	10
1. Royalty Fee @ 5% of Total Revenue (Exhibit 15.5, Line 3)		2.78	6.41	7.39	8.30	9.14	9.88	10.48	11.01	11.46	11.80
2. Spanish Withholding Tax @ 10% (0.10 × Line 1)		0.28	0.64	0.74	0.83	0.91	0.99	1.05	1.10	1.15	1.18
3. Overhead Fee @ 2% of Total Revenue (Exhibit 15.5, Line 4)		1.11	2.56	2.96	3.32	3.66	3.95	4.19	4.40	4.58	4.72
4. Spanish Withholding Taxes @ 14% (0.14 × Line 3)		0.16	0.36	0.41	0.46	0.51	0.55	0.59	0.62	0.64	0.66
5. After-Tax Fees Received by IWPI-U.S. (Line 1 − Line 2 + Line 3 − Line 4)		3.45	7.97	9.20	10.32	11.37	12.29	13.04	13.70	14.25	14.68
6. Tentative U.S. Tax Liability @ 34% (0.34 × (Line 1 + Line 3))		1.32	3.05	3.52	3.95	4.35	4.70	4.99	5.24	5.45	5.62
7. Excess Foreign Tax Credit from Dividends (Exhibit 15.10, Line 5)		0.00	0.35	1.31	1.64	1.94	2.20	2.16	2.13	2.07	1.95
8. Net U.S. Tax Owed (Line 6 − Line 2 − Line 4 − Line 7)		0.89	1.70	1.06	1.02	0.99	0.96	1.19	1.39	1.60	1.82
9. After-Tax Value of Fees to IWPI-U.S. (Line 5 − Line 8)		2.57	6.27	8.14	9.30	10.38	11.33	11.85	12.31	12.65	12.86
10. Discount Factors (@ 11.1% per annum)		0.90	0.81	0.73	0.66	0.59	0.53	0.48	0.43	0.39	0.35
11. Present Value of After-Tax Fees (Line 8 × Line 9)		2.31	5.08	5.94	6.10	6.13	6.02	5.67	5.30	4.91	4.49
12. Terminal Value of Fees	50.31										
13. NPV of After-Tax Fees (Sum of Line 11 + Line 12)	102.26										

Notes: All numbers except the discount factors are in millions of euros. The terminal value is the discounted value of fees from years 11 to infinity, calculated as a perpetuity growing at the euro rate of inflation of 2%.

For example, in year 2, IWPI-U.S. receives €7.97 million of after-withholding-tax fees, based on €8.97 million of gross income. This gross income generates a tentative U.S. tax liability of €3.05 million. But IWPI-U.S. paid withholding taxes of €0.64 million on the royalty and €0.36 million on the overhead, for which it receives foreign tax credits. IWPI-U.S. can also use the €0.35 million of excess foreign tax credits associated with the income tax on its dividends, calculated in Exhibit 15.10, to offset U.S. tax owed. The net result is a tax liability of

$$€3.05 \text{ million} - €0.64 \text{ million} - €0.36 \text{ million} - €0.35 \text{ million} = €1.70 \text{ million}$$

Subtracting the actual U.S. tax liability in Line 8 of Exhibit 15.12 from the after-tax fees received in Line 5 gives the after-tax value of the fees to IWPI-U.S. shown in Line 9. These profits are also discounted at 11.1% per annum, and the discount factors are again presented in Line 10. Multiplying the expected values in Line 9 by the discount factors in Line 10 gives the present values of the fees in Line 11. The terminal value of the fees for years 11 to the indefinite future discounted to year 0 is €50.31 million, and it is calculated just like the terminal value of dividends. The net present value of the fees, which is the sum of the discounted values in Line 11 and the terminal value in Line 12, is €102.26 million.

Forecasting the Profits Earned from Intermediate Goods

Because IWPI-U.S. sells intermediate parts to IWPI-Spain, additional profit accrues to IWPI-U.S. Exhibit 15.13 calculates the net present value of these export profits. Export revenue is

Exhibit 15.13 Net Present Value of After-Tax Profit on Intermediate Goods Sold by IWPI-U.S. to IWPI-Spain

	Year in the Future										
	0	1	2	3	4	5	6	7	8	9	10
1. Unit Sales (Exhibit 15.3, Line 2)		22,000	48,840	54,701	60,171	64,985	68,884	71,639	73,788	75,264	76,017
2. Per-Unit Price of Exported Parts (Exhibit 15.5, Line 1.c)		407	423	436	445	454	463	472	481	491	501
3. Export Revenue of IWPI-U.S. (Line 1 × Line 2)		8.95	20.67	23.85	26.76	29.48	31.87	33.81	35.52	36.95	38.07
4. Before-Tax Profit @ 16% Margin (0.16 × Line 3)		1.43	3.31	3.82	4.28	4.72	5.10	5.41	5.68	5.91	6.09
5. U.S. Corporate Tax @ 34% (0.34 × Line 4)		0.49	1.12	1.30	1.46	1.60	1.73	1.84	1.93	2.01	2.07
6. After-Tax Profit (Line 4 − Line 5)		0.95	2.18	2.52	2.83	3.11	3.37	3.57	3.75	3.90	4.02
7. Discount Factors (@ 11.1% per annum)		0.90	0.81	0.73	0.66	0.59	0.53	0.48	0.43	0.39	0.35
8. Present Value of After-Tax Profits (Line 6 × Line 7)		0.85	1.77	1.84	1.85	1.84	1.79	1.71	1.62	1.51	1.40
9. Terminal Value of Profits	15.73										
10. NPV of After-Tax Profits (sum of Line 8 + Line 9)	31.91										

Notes: All numbers except Lines 1 and 2 and the discount factors are in millions of euros. The terminal value is the discounted value of profits from years 11 to infinity, calculated as a perpetuity growing at the euro rate of inflation of 2%.

calculated in Line 3 as the product of the euro price of exported parts per unit in Line 2 multiplied by the unit sales forecast in Line 1.

The profit margin on these export sales is known to be 16%, and this is calculated in Line 4. U.S. corporate income tax on this profit is 34% in Line 5, and the after-tax profits are presented in Line 6. The present value of these expected profits on export sales is €31.91 million.

Valuing the Financial Side Effects

IWPI-U.S. also gets value from the financial side effects associated with the project. The Spanish government is offering a subsidized loan, and the interest payments provide valuable interest tax shields. When the Spanish government loan is repaid, IWPI-U.S. also plans to issue perpetual debt. Let's begin with the valuation of the interest tax shields in Exhibit 15.14.

Interest Tax Shields

The interest rate on the Spanish government loan is 3% per annum, the principal on the loan is €30 million, and the maturity of the loan is 10 years. Hence, for the next 10 years, IWPI-Spain will make annual interest payments of

$$0.03 \times €30 \text{ million} = €0.9 \text{ million}$$

These interest payments are valuable because they are tax deductible. Consequently, they increase the value of the project each year by the Spanish tax rate multiplied by the interest payment:

$$0.35 \times €0.9 \text{ million} = €0.315 \text{ million}$$

Exhibit 15.14 Net Present Value of Interest Tax Shields

	Year in the Future										
	0	1	2	3	4	5	6	7	8	9	10
1. Tax Rate × Interest Paid		0.315	0.315	0.315	0.315	0.315	0.315	0.315	0.315	0.315	0.315
2. Discount Factors (@ 6.00% per annum)		0.94	0.89	0.84	0.79	0.75	0.70	0.67	0.63	0.59	0.56
3. Present Value of Interest Tax Shields (Line 1 × Line 2)		0.30	0.28	0.26	0.25	0.24	0.22	0.21	0.20	0.19	0.18
4. Terminal Value of Tax Shields	8.97										
5. NPV of Interest Tax Shields (sum of Line 3 + Line 4)	11.29										

Note: All numbers except the discount factors are in millions of euros.

If IWPI-Spain were certain that it would make these interest payments, the tax shields should be discounted at the euro risk-free interest rate. In a more likely scenario, though, the interest payments would not be risk free because there would be a probability of IWPI-Spain failing and being forced into bankruptcy. If there is a bankruptcy probability, the firm's debt will not be risk free, and the firm will not expect to make the full value of the interest payments.

Suppose that IWPI-U.S. knows from its investment bankers that if it were to issue 10-year bonds, it would borrow euros at an interest rate that is 150 basis points above the euro risk-free rate of 4.5%. Thus, IWPI-Spain's euro-denominated market interest rate is 4.5% + 1.5% = 6%. The increase in the required interest rate above the risk-free rate reflects the market's assessment of possible default by IWPI.

If the risk of default on the Spanish government loan is the same as the risk of default on a market loan, then 6.0% is the appropriate rate to discount the interest tax shields. The present value of these interest tax shields is the sum of the numbers in Line 3, or €2.32 million.

If IWPI-U.S. issues €30 million of debt in year 11 at its market interest rate of 6%, and if this debt is expected to grow each year at the euro rate of inflation of 2%, the terminal value of the interest tax shields would be

$$\text{Terminal value of interest tax shield} = \frac{0.35 \times 0.06 \times \text{€}30 \text{ million} \times (1.02)}{(0.06 - 0.02) \times (1.06^{10})}$$

$$= \text{€}8.97 \text{ million}$$

The full value of the interest tax shield is therefore €2.32 million + €8.97 million = €11.29 million. This calculation no doubt overstates the value of debt to the corporation because it ignores the costs of financial distress.

Interest Subsidies

IWPI-U.S. also obtains value from the interest subsidy provided by the Spanish government. If IWPI had to borrow €30 million at its market interest rate of 6.0% per annum, its annual interest payment would be

$$0.06 \times \text{€}30 \text{ million} = \text{€}1.8 \text{ million}$$

Because the Spanish government only charges 3% per annum, IWPI's actual interest payment is €0.9 million. Therefore, the annual interest savings is

$$\text{€}1.8 \text{ million} - \text{€}0.9 \text{ million} = \text{€}0.9 \text{ million}$$

Exhibit 15.15 Net Present Value of Interest Subsidy

	Year in the Future										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Interest Subsidy		0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
2. Discount Factors (@ 6.00% per annum)		0.94	0.89	0.84	0.79	0.75	0.70	0.67	0.63	0.59	0.56
3. Present Value of Interest Subsidy (Line 1 × Line 2)		0.85	0.80	0.76	0.71	0.67	0.63	0.60	0.56	0.53	0.50
4. NPV of Interest Subsidy (sum of Line 3)	6.62										

Note: All numbers except the discount factors are in millions of euros.

Exhibit 15.15 values this subsidy using the firm's market interest rate of 6.0%. The net present value of the interest subsidy is €6.62 million.

The Full ANPV of IWPI-Spain

The initial cost of the IWPI-Spain project is €178.66 million. This is the sum of the initial capital expenditures for plant and equipment and the initial investment in cash and inventory. Exhibit 15.11 calculates that the net present value of the after-tax dividends that will be returned to IWPI-U.S. from IWPI-Spain is €160.84 million. Line 13 of Exhibit 15.12 calculates the net present value of after-tax royalty and overhead fees as €102.26 million. Line 10 of Exhibit 15.13 calculates the net present value of after-tax profits on the sale of intermediate export goods as €31.91 million. The value of the interest tax shield on the loan from the Spanish government is €11.29 million, and the value of the interest subsidy is €6.62 million. Upon adding together all the costs and benefits of the project, we find

$$\begin{aligned}\text{ANPV of IWPI-Spain} &= -€178.66 \text{ million in initial costs}\\ &\quad +€160.84 \text{ million from dividends}\\ &\quad +€102.26 \text{ million from royalties and fees}\\ &\quad +€31.91 \text{ million from exports}\\ &\quad +€11.29 \text{ million from the interest tax shield}\\ &\quad +€6.62 \text{ million from the interest subsidy}\\ &= €134.26 \text{ million}\end{aligned}$$

At the current exchange rate of $\$1.40/€$, the dollar value to IWPI-U.S. of setting up a Spanish subsidiary is

$$(\$1.40/€) \times €134.26 \text{ million} = \$187.97 \text{ million}$$

The initial cost of the project is

$$(\$1.40/€) \times €178.66 \text{ million} = \$250.12 \text{ million}$$

Thus, by investing $250.12 million, IWPI-U.S. is purchasing a series of uncertain, risky cash flows worth

$$\$250.12 \text{ million} + \$187.97 \text{ million} = \$438.09 \text{ million}$$

The $438.09 million is the enterprise value of the project, which is the sum of the value of debt and equity. Because IWPI is able to borrow €30 million = $42 million from the Spanish government, the equity value of the project is $396.09 million. Shareholders also only need to invest €148.66 million. So, by investing $208.12 million = $1.40/€ × €148.66 million of shareholders' wealth, the shareholders are able to almost double their wealth. This is clearly a good managerial decision unless the opportunity cost of lost export sales is too large.

Cannibalization of Export Sales

The final part of the valuation of IWPI-Spain involves the possibility that IWPI-U.S. may not have another market for the 40,000 units it is currently exporting to Europe. If it does not have another market, the lost profit on these exports is a cost of creating the Spanish subsidiary.

Exhibit 15.16 presents the net present value of the after-tax profit on sales of 40,000 units between the current year and the indefinite future. Units exported are held constant in Line 1, except in year 1, because IWPI-U.S. is currently exporting its maximum capacity from the New Hampshire manufacturing facility. Lost sales in the first year are 18,000 units because the Spanish facility will produce 22,000 units, and total European demand is 44,000. Hence, IWPI-U.S. can export 22,000 units to Europe and will only lose profit on 40,000 − 22,000 = 18,000 units.

Prices per unit are given in Line 2 and correspond to the euro prices forecast in Exhibit 15.3, Line 4. Export revenue is given in Line 3 as the euro price per unit multiplied by the number of units exported. Line 4 presents the profit on these export sales, assuming a profit margin of 16%, the same profit margin as on the intermediate part exports. Line 5 calculates the IWPI-U.S. corporate income tax liability as 34% of the profits in Line 4. After-tax profits are reported in Line 6. Because these are forecasts of risky euro cash flows, it is again appropriate to discount them at 11.1% per annum. The discount factors are presented in Line 7.

Multiplying the discount factor by the after-tax profit provides the present values of each of the cash flows in Line 8. Line 9 presents the year 0 value of the terminal value, which is calculated as a perpetuity growing at the euro rate of inflation of 2% and discounted at 11.1%.

Exhibit 15.16 Net Present Value of After-Tax Profit on Lost Export Sales by IWPI-U.S.

	Year in the Future										
	0	1	2	3	4	5	6	7	8	9	10
1. Unit Export Sales		18,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
2. Price per Unit (Exhibit 15.3, Line 4)		2,524	2,624	2,703	2,757	2,812	2,869	2,926	2,985	3,044	3,105
3. Export Revenue (Line 1 × Line 2)		45.42	104.98	108.13	110.29	112.50	114.75	117.04	119.38	121.77	124.20
4. Before-Tax Profit @ 18% Margin (0.16 × Line 3)		7.27	16.80	17.30	17.65	18.00	18.36	18.73	19.10	19.48	19.87
5. U.S. Corporate Tax @ 34% (0.34 × Line 4)		2.47	5.71	5.88	6.00	6.12	6.24	6.37	6.49	6.62	6.76
6. After-Tax Profit (Line 4 − Line 5)		4.80	11.09	11.42	11.65	11.88	12.12	12.36	12.61	12.86	13.12
7. Discount Factors (@ 11.1% per annum)		0.90	0.81	0.73	0.66	0.59	0.53	0.48	0.43	0.39	0.35
8. Present Value of After-Tax Profits (Line 6 × Line 7)		4.32	8.98	8.33	7.64	7.02	6.44	5.92	5.43	4.99	4.58
9. Terminal Value of Profits	51.31										
10. NPV of After-Tax Profits (sum of Line 8 + Line 9)	114.95										

Notes: All numbers except Lines 1 and 2 and the discount factors are in millions of euros. The Terminal Value is the discounted value of profits from years 11 to infinity calculated as a perpetuity growing at the euro rate of inflation of 2%.

The sum of the cash flows in Line 8 and the terminal value of lost profits from year 11 to the indefinite future in Line 9 is the net present value of the after-tax profits from lost export sales. In Line 10, the year 0 value of the after-tax profits on all lost sales is €114.95 million.

Because the ANPV of the project without lost export sales was €134.26 million, even if IWPI-U.S. does not have another market for its current exports, it should still establish IWPI-Spain, although the increase in the enterprise value of the firm is now substantially smaller

$$(€134.26 \text{ million} - €114.95 \text{ million}) = €19.31 \text{ million}$$

15.7 Summary

In this chapter, we develop the adjusted net present value (ANPV) approach to capital budgeting, and we apply the ANPV approach to value a foreign subsidiary. The important points in the chapter are the following:

1. Corporations use capital budgeting to decide how to allocate funds for investment projects, and they should accept all projects with a positive ANPV.
2. The first part of an ANPV calculates the net present value (NPV) of the project's free cash flows assuming the project is financed entirely with equity. Any benefits or costs associated with issuing debt are valued later. The discount rate should reflect the riskiness of the project's free cash flows.
3. The second part of an ANPV analysis adds the net present value of financial side effects (NPVF) associated with the project, which arise from the direct costs of issuing securities, from taxes or tax deductions because of the type of financing instrument used, from the costs of financial distress, and from subsidized financing provided by governments.
4. The third part of an ANPV analysis adds the present value of any real options that arise from doing the project.
5. Free cash flow is the profit available for distribution to a firm's shareholders and is defined as the after-tax operating earnings of the corporation, plus any non-cash accounting charges, minus the investments of the firm. These investments involve increases in the firm's net working capital and capital expenditures on property, plant, and equipment.
6. The pretax operating income that a firm would have if it had no debt is EBIT (operating earnings before interest and taxes):

$$\begin{aligned}\text{EBIT} = \text{Revenue} - \text{Costs of goods sold} \\ - \text{Selling and general administrative} \\ \text{expense} - \text{Depreciation}\end{aligned}$$

7. Net operating profit less adjusted taxes (NOPLAT) equals EBIT minus taxes on EBIT.
8. The terminal value of a project represents the present value of all expected future free cash flows in the years extending into the indefinite future beyond the explicit forecast horizon of the project and can be calculated using perpetuity formulas.
9. If a corporation does not have enough free cash flow to finance a project, it must turn to outside investors for additional resources. The costs of raising funds must be subtracted from the value of the project.
10. When a firm issues debt, the interest payments on the debt are tax deductible because the government views interest as a cost of doing business. Thus, debt financing reduces a corporation's income taxes and increases the value of the corporation. The value of the ability to deduct interest payments for tax purposes is called an interest tax shield.
11. The costs of financial distress refer to the loss of firm value that occurs because the firm may experience bankruptcy. These costs include direct costs due to bankruptcy and indirect costs due to the following: loss of customers who choose not to purchase the firm's products, problems with suppliers who have no long-term interest in the firm, inability of the firm to hire and retain high-quality managers and skilled workers, and poor investment decisions managers may make when the firm faces possible bankruptcy in the future.
12. The value of a subsidized loan is the difference between the interest payments on a loan of the same size at market interest rates and the interest payments on the subsidized loan discounted to the present by the market's required rate of return on the debt.
13. If, when a firm undertakes a project, it obtains an option to do another project in future, the option value of the second project adds value to the first project. In international finance, an important example of

such a growth option is the decision to enter a foreign market to sell a firm's products.

14. Because there can be a substantial difference between the cash flows from a project that accrue to a foreign subsidiary versus the cash flows that can ultimately be paid to the parent company, a three-step approach to international capital budgeting is appropriate. The first step involves doing an NPV free cash flow analysis on the foreign subsidiary as if it were an independent all-equity firm, recognizing that the royalty payments, licensing fees, and management fees that the subsidiary must pay the parent are costs to the subsidiary. The second step involves valuing the free cash flow of the subsidiary from the parent's perspective, including the withholding taxes on the dividends repatriated to the parent, and then adding back the after-tax value of royalty payments, licensing fees, and management fees paid by the subsidiary, along with any profits on the sale of intermediate parts to the subsidiary. The third step involves adjusting the value of the project for the net present value of the project's financial side effects and growth options.
15. The cannibalization of exports to the market that will be served by a foreign subsidiary can substantially reduce the value of establishing the subsidiary. These lost exports could be from the parent or from another foreign subsidiary in a different country.

Questions

1. Can an investment project of a foreign subsidiary that has a positive net present value when evaluated as a stand-alone firm ever be rejected by the parent corporation? Assume that the parent accepts all projects with positive adjusted net present values.
2. How do licensing agreements, royalties, and overhead allocation fees affect the value of a foreign project?
3. Why does an adjusted net present value analysis treat the present value of financial side effects as a separate item? Isn't interest expense a legitimate cost of doing business?
4. What is meant by the net present value of the financial side effects of a project?
5. Why is it costly to issue securities?
6. What is an interest tax shield? How do you calculate its value?
7. What is an interest subsidy? How do you calculate its value?
8. What are growth options? Provide an example of one in an international context.
9. What is the difference between EBIT and NOPLAT?
10. Why is it important to understand and manage net working capital?
11. What does CAPX mean, and why is it a firm's engine of growth?
12. Why is it sometimes assumed that CAPX equals depreciation in the later stages of a project? How does expected inflation affect this assumption?
13. What is the terminal value of a project? How is it calculated?
14. What is meant by the cannibalization of an export market?
15. What are the primary sources of value to IWPI-U.S. in establishing a Spanish subsidiary?
16. Why are the profits on exports of intermediate parts by IWPI-U.S. to IWPI-Spain included in the value of the project?
17. What risks are present in the IWPI-Spain project? How do they affect the value of the project?

Problems

1. What percentage of the adjusted net present value of the IWPI-Spain project arises from the dividends that will occur more than 10 years in the future?
2. How sensitive is the value of IWPI-Spain to the assumed discount rate of 11.1%? What happens to the value of the project if the rate is 12.1% instead?
3. What would be the terminal values of the dividends from IWPI-Spain if they were expected to grow in real terms at 1% rather than 0%? How would this growth arise?
4. How much does the value of IWPI-Spain, viewed as a stand-alone firm, change if the royalty fee is increased by 1% and the overhead allocation fee is reduced by 1%? What is the change in value to IWPI-U.S.? What is the source of this change in value?

5. **Valuing Metallwerke's Contract with Safe Air, Inc.**
Consider the discounted expected value of the 10-year contract that Metallwerke may sign with Safe Air in Chapter 9. In the initial year of the deal, Metallwerke sells an air tank to Safe Air for $400. It costs €238 to produce an air tank. The current exchange rate is $1.40/€. Assume that 15,000 air tanks will be sold the first year. Make the following other assumptions in your valuation:
   a. The demand for air tanks is expected to grow at 5% for the second year, 4% for the third and fourth years, and 3% for the remaining life of the contract.
   b. Euro-denominated costs are expected to increase at the euro rate of inflation of 2%.
   c. The base dollar price of the air tank will be increased at the U.S. rate of inflation plus one-half of any real depreciation of the dollar relative to the euro, but the base dollar price will be reduced by one-half of any appreciation of the dollar relative to the euro. The U.S. rate of inflation is expected to be 4%.
   d. The dollar is currently not expected to strengthen or weaken in real terms relative to the euro.
   e. The German corporate income tax rate is 30%.
   f. The appropriate euro discount rate for the project is 12%.
   g. Metallwerke typically establishes an account receivable for its customers. At any given time, the stock of the account receivable is expected to equal 10% of a given year's revenue.
   h. Accepting the Safe Air project will not require any major capital expenditures by Metallwerke.

   Can you determine the value of the contract to Metallwerke?
6. **Deli-Delights Inc.**
Deli-Delights Inc. is a U.S. company that is considering expanding its operations into Japan. The company supplies processed foods to storefront delicatessens in large cities. This requires Deli-Delights to have a centralized production and warehousing facility in each of these cities. Deli-Delights has located a possible site for a Japanese subsidiary in Tokyo. The cost to purchase and equip the facility is ¥765,000,000. Perform an ANPV analysis to determine whether this is a good investment, under the following assumptions:
   a. The average per-unit sales price will initially be ¥410.
   b. First-year sales will be 15 million units, and physical sales will then grow at 10% per annum for the next 3 years, 5% per annum for the 3 years after that, and then stabilize at 3% per annum for the indefinite future.
   c. First-year variable costs of production will be ¥225 per unit of labor and $1.75 per unit of imported semi-finished goods. Administrative costs will be ¥300 million.
   d. Depreciation will be taken on a straight-line basis over 20 years.
   e. Retail prices, labor costs, and administrative expenses are expected to rise at the Japanese yen rate of inflation, which is forecast to be 1%. Dollar prices of semi-finished goods are expected to rise at the U.S. dollar rate of inflation, which is expected to be 4%.
   f. The yen/dollar exchange rate is currently ¥85/$, and the yen is expected to appreciate at a rate justified by the expected inflation differential between the yen and dollar rates of inflation.
   g. There will be a 4% royalty paid by the Japanese subsidiary to its U.S. parent.
   h. The Japanese corporate income tax rate is 37.5%, and there is a 10% withholding tax on dividends and royalty payments.
   i. The yen-denominated equity discount rate for the project is 13%.
   j. Net working capital will average 6% of total sales revenue.
   k. Capital expenditures will offset depreciation.
   l. All of the Japanese subsidiary's free cash flow will be paid to the parent as dividends.
   m. The corporate income tax rate for the United States is 34%.
   n. Deli-Delights Inc. has sufficient other foreign income that will allow it to fully utilize any excess foreign tax credits generated by its Japanese subsidiary.
   o. Deli-Delights Inc. does not plan to issue any debt associated with this project.
7. Web Question: Go to http://investor.google.com and find Google's latest annual income statement. Determine its free cash flow. If you discount its free cash flow as a perpetuity growing at rate *g*, and you discount at 12%, what perpetual growth rate justifies Google's current market price?

Bibliography

Altman, Edward I., 1984, "A Further Empirical Investigation of the Bankruptcy Cost Question," *Journal of Finance* 39, pp. 1067–1089.

Grenadier, Steven, 2002, "Option Exercise Games: An Application to the Equilibrium Investment Strategies of Firms," *Review of Financial Studies* 15, pp. 691–721.

Jensen, Michael C., 1986, "Agency Costs of Free Cash Flow, Corporate Finance and Takeovers," *American Economic Review* 76, pp. 323–329.

Kalay, Avner, Rajeev Singhal, and Elizabeth Tashjian, 2007, "Is Chapter 11 Costly?" *Journal of Financial Economics* 84, pp. 772–796.

Koller, Tim, Marc Goedhart, and David Wessels, 2005, *Valuation: Measuring and Managing the Value of Companies*, 4th ed., Hoboken, NJ: John Wiley and Sons.

Lee, Inmoo, Scott Lockhead, Jay Ritter, and Quanshui Zhao, 1996, "The Costs of Raising Capital," *Journal of Financial Research* 19, pp. 59–74.

Procter & Gamble, 1991, "Procter & Gamble in Brazil," Procter & Gamble case.

White, Michelle J., 1983, "Bankruptcy Costs and the New Bankruptcy Code," *Journal of Finance* 38, pp. 477–488.

Appendix

Deriving the Value of a Perpetuity

This appendix derives perpetuity formulas that are used to calculate the terminal value of a sequence of growing free cash flows. Recall that a perpetuity is an infinite sum. Suppose that the growth rate is g so that each cash flow forecast is g% higher than the previous value, that each cash flow is discounted at r, and that we are deriving a terminal value for year 10. Thus, based on the forecast of free cash flow in year 10, which we denote $E_t[FCF(t{+}10)]$, we have

$$\text{Terminal value in year 10} = \text{PV of cash flows in years } 11 + 12 + 13 + \ldots$$

$$= \frac{E_t[FCF(t{+}10)](1+g)}{(1+r)} + \frac{E_t[FCF(t{+}10)](1+g)^2}{(1+r)^2} + \frac{E_t[FCF(t{+}10)](1+g)^3}{(1+r)^3} + \ldots$$

To evaluate this infinite sum, define $\lambda = [(1+g)/(1+r)]$, and move the common term, $E_t[FCF(t{+}10)][(1+g)/(1+r)]$, outside the brackets. Then, we have

$$\text{Terminal value in year 10} = \frac{E_t[FCF(t{+}10)](1+g)}{(1+r)}[1 + \lambda + \lambda^2 + \ldots]$$

Clearly, for this infinite sum to be a finite number, it must be the case that $\lambda < 1$, which requires that $g < r$. Thus, the growth rate of expected future free cash flows must be less than the discount rate. We know that the value of the infinite sum is $\frac{1}{(1-\lambda)}$. After substituting for the infinite sum and for λ, we have

$$\text{Terminal value in year 10} = \frac{E_t[FCF(t{+}10)](1+g)}{(r-g)}$$