Capital Investment Decisions: An Overview

Appendix

Introduction

Capital investment decisions are the responsibility of managers of investment centers (see Chapter 12). The analysis of capital investment decisions is a major topic in corporate finance courses, so we do not discuss these issues and methods here in any detail. However, because cost accountants are involved in the development of performance measurement techniques for investment center managers, we provide an outline of the issues and methods of capital budgeting in this appendix.

Capital investments often involve large sums of money and considerable risk. Specific investments over a certain dollar amount, often in the \$100,000 to \$500,000 range (or less for small companies), require approval by the board of directors in many companies. Although the final decision about asset acquisition is management's responsibility, accountants, economists, and other financial experts have developed capital investment models to help managers make those decisions. Accountants have the particularly important role of estimating the amount and timing of the cash flows used in capital investment decision models.

Analyzing Cash Flows for Present Value Analysis

Capital investment models are based on the future cash flows expected from a particular asset investment opportunity. The amount and timing of the cash flows from a capital investment project determine its economic value. The timing of those flows is important because cash received earlier in time has greater economic value than cash received later. As soon as cash is received, it can be reinvested in an alternative profit-making opportunity. Thus, any particular investment project has an opportunity cost for cash committed to it. Because the horizon of capital investment decisions extends over many years, the **time value of money** is often a significant decision factor for managers making these decisions.

time value of money Concept that cash received earlier is worth more than cash received later.

To recognize the time value of money, the future cash flows associated with a project are adjusted to their present value using a predetermined discount rate. Summing the discounted values of the future cash flows and subtracting the initial investment yields a

net present value (NPV) Economic value of a project at a point in time.

discount rate Interest rate used to compute net present values.

project's **net present value (NPV)**, which represents the economic value of the project to the company at a given point in time.

The decision models used for capital investments attempt to optimize the economic value to the firm by maximizing the net present value of future cash flows. If the net present value of a project is positive, the project will earn a rate of return higher than its **discount rate,** which is the rate used to compute net present value.

Distinguishing between Revenues, Costs, and Cash Flows

A *timing difference* often exists between revenue recognition and cash inflow on the one hand and the incurrence of a cost and the related cash outflow on the other hand. When this occurs, it is important to *distinguish cash flows from revenues and costs.* Note that capital investment analysis uses *cash flows, not revenues and costs.* For example, revenue from a sale often is recognized on one date but not collected until later. In such cases, the cash is not available for other investment or consumption purposes until it is collected.

Net Present Value

present value Amounts of future cash flows discounted to their equivalent worth today.

The **present value** of cash flows is the amount of future cash flows discounted to their equivalent worth today. The *net present value* of a project can be computed by using the equation:

$$NPV = \sum_{n=0}^{N} C_n \times (1 + d)^{-n}$$

where

C_n = Cash to be received or disbursed at the end of time period n

d = Appropriate discount rate for the future cash flows

n = Time period when the cash flow occurs

N = Life of the investment, in years

The term $(1 + d)^{-n}$ is called a *present value factor*. A financial calculator or computer spreadsheet is the most efficient way to compute present value factors and net present values. Tables of present value factors are at the end of this appendix in Exhibit A.8.

An *annuity* is a constant (equal) payment over a period of time. The present value of an annuity can be computed by calculating the present value of the individual payments and summing them over the annuity period. Alternatively, they can be computed by multiplying the annuity payment by the sum of the present value factors. The present value factors for an annuity are shown in Exhibit A.9.

If you use the table in Exhibit A.8, look up the factor by referring to the appropriate year and discount rate. For a discount rate of 8 percent and a cash flow of $1 at the end of two years, the present value factor in Exhibit A.8 is .857. For a discount rate of 8 percent and a cash flow of $1 at the end of *each* year for two years (an annuity), the present value factor in Exhibit A.9 is 1.783 (= 0.926 + 0.857, from Exhibit A.8).

Applying Present Value Analysis

Consider two projects. Each requires an immediate cash outlay of $10,000. Project 1 will return $13,000 at the end of two years; Project 2 will return $6,500 each year at the end of years 1 and 2. If the appropriate discount rate is 15 percent, the net present value of each project can be computed as follows:

Project 1		
Cash inflow.	$\$13{,}000 \times (1 + .15)^{-2}$	
	$= \$13{,}000 \times .756$	$ 9,828
Cash outflow		(10,000)
Net present value . . .		$ (172)
Project 2		
Cash inflow.	$\$6{,}500 \times (1 + .15)^{-1} + \$6{,}500 \times (1 + .15)^{-2}$	
	$= \$6{,}500 \times .870 + \$6{,}500 \times .756$	$ 10,569
Cash outflow		(10,000)
Net present value . . .		$ 569

The starting time for capital investment projects is assumed to be time 0. Therefore, any cash outlays required at the start of the project are not discounted. We enter them at their full amount.

At a discount rate of 15 percent, Project 2 is acceptable, but Project 1 is not. Project 2 will earn more than the required 15 percent return while Project 1 will earn less. The reason is that, although both projects returned a total of $13,000, Project 2 returned half of it one year earlier.

You should check for yourself to see that at a 20 percent discount rate, the present value of both projects is negative. Therefore, if the required rate were 20 percent, neither project would meet the investment criterion. Alternatively, at 10 percent, both projects have positive net present values and would be acceptable.

Capital Investment Analysis: An Example

We present the following numerical example to illustrate the basics of capital investment analysis. The owners of Mezzo Diner are considering an expansion, which will require some additional equipment. Basic data for the investment are shown in Exhibit A.1. Mezzo uses straight-line depreciation for tax purposes.

Exhibit A.1
Selected Expansion Data—Mezzo Diner

Equipment cost	$600,000
Economic and tax life	5 years
Disposal value	$100,000
Additional annual cash revenue	$400,000
Additional annual cash operating expenses	$170,000
Increase in working capital required	$120,000
Tax rate	40%
Discount rate	12%

Categories of Project Cash Flows

This section outlines a method for estimating cash flows for investment projects, which we illustrate using the expansion project of Mezzo Diner. We start by setting four major categories of cash flows for a project:

- Investment cash flows.
- Periodic operating cash flows.
- Cash flows from the depreciation tax shield.
- Disinvestment cash flows.

Each category of cash flows requires a separate treatment.

Investment Cash Flows

There are three types of investment cash flows:

1. Asset acquisition, which includes
   a. New equipment costs, including installation (outflow).
   b. Proceeds of existing assets sold, net of taxes (inflow).
   c. Tax effects arising from a loss or gain (inflow or outflow).
2. Working capital commitments.
3. Investment tax credit, if any.

asset acquisition
Costs of purchasing and installing an asset including any resulting gain or loss on disposal.

Asset Acquisition **Asset acquisition** involves both the cost of purchasing and installing new assets and the cash inflows that can result from the proceeds, net of taxes, of selling replaced equipment. Additionally, there could be a loss or gain from the difference between the sale proceeds and the tax basis of the equipment being replaced.

The primary outflow for most capital investments is the acquisition cost of the asset. Acquisition costs can be incurred in time 0 and in later years. In some cases, they are incurred over periods of 10 to 20 years. All acquisition costs are listed as cash outflows in the years in which they occur. Installation costs are also considered a cash outflow.

If the depreciation tax basis of the replaced equipment does not equal the proceeds received from the sale of the replaced equipment, a gain or loss will occur and will affect the tax payment. The tax effect will be considered a cash inflow (for a loss) or a cash outflow (for a gain).

The calculation of this category for Mezzo is straightforward because it is not disposing of another asset. The initial outflow is the $600,000 purchase price of the equipment.

working capital
Cash, accounts receivable, and other short-term assets required to maintain an activity.

Working Capital Commitments In addition to the cash required for the purchase of long-term assets, many projects require additional funds for **working capital** needs; for example, a retail establishment needs to have cash available in a bank account because future cash payments often precede cash receipts. The working capital committed to the project normally remains constant over the life of the project, although it is sometimes increased because of inflation. Mezzo plans to commit an additional $120,000 in working capital at time 0 to maintain a cash balance in a bank account to cover future cash transactions.

investment tax credit (ITC)
Reduction in federal income taxes arising from the purchase of certain assets.

Investment Tax Credit The **investment tax credit (ITC)** allows a credit against the federal income tax liability based on the cost of an acquired asset. This credit effectively reduces the cost of making investments by giving companies a credit against their corporate income taxes equal to, for example, 10 percent of the purchase price. The investment tax credit has been in effect at various times since the early 1960s. Currently, there is no investment tax credit for which Mezzo qualifies.

Periodic Operating Cash Flows

The primary reason for acquiring long-term assets is usually to generate positive *periodic operating cash flows*. These positive flows can result from *revenue-generating* activities, such as new products, and from *cost-saving* programs. In either case, actual cash inflows and outflows from operating the asset are usually determinable in a straightforward manner. The most important task is to identify and measure the cash flows that will differ because of the investment. *If the revenues and costs are differential cash items, they are relevant for the capital investment decision.*

Periodic operating flows include the following:

Period cash inflows (+) and outflows (−) before taxes.
Income tax effects of inflows (−) and outflows (+).

Costs that do not involve cash (depreciation, depletion, and amortization) are excluded. If cash costs in other departments change as a result of the project, the costs of the other department(s) should be included in the differential cash flow schedule. Mezzo forecasts annual increases in cash revenues of \$400,000 and increased cash operating expenses of \$170,000. After tax, these will result in net cash flows of \$138,000 [= (\$400,000 − \$170,000) × (1 − 40%)].

Financing costs such as interest costs on loans, principal repayments, and payments under financing leases are typically excluded under the assumption that the financing decision is separate from the asset-acquisition decision. Under this assumption, the decision to acquire the asset is made first. If the asset-acquisition decision is favorable, a decision will be made to select the best financing. For analysis purposes, asset acquisitions typically are recorded in the full amount when the cash purchase payments are made, regardless of how that cash was acquired. The cost of financing is included in the discount rate.

Tax Effects of Periodic Cash Flows The income tax effects of the periodic cash flows from the project are also computed and considered in the present value analysis. Note that for purposes of calculating the net present value, only the tax effects related to differential project cash flows are considered.

The steps to compute the net operating cash flows for the project are repeated for each year of the project's life. In some cases, the computations can be simplified by using an annuity factor if the project is expected to yield identical cash flows for more than one year.

Cash Flows from the Depreciation Tax Shield

To measure the income of an organization or one of its subunits, depreciation is used to allocate the cost of long-term assets over their useful lives. These depreciation charges are not cash costs and thus do not directly affect the net present values of capital investments. However, tax regulations permit depreciation write-offs that reduce the required tax payment. The reduction in the tax payment is referred to as a **tax shield.** *The depreciation deduction computed for this tax shield is not necessarily the same amount as the depreciation computed for financial reporting purposes.* The predominant depreciation method for financial reporting has been the *straight-line method.* With this method, the cost of the asset, less any salvage value, is allocated equally to each year of the expected life of the asset. Income tax regulations allow depreciation write-offs to be made faster.

tax shield
Reduction in tax payment because of depreciation deducted for tax purposes.

The tax allowance for depreciation is one of the primary incentives used by tax policymakers to promote investment in long-term assets. The faster an asset's cost can be written off for tax purposes, the sooner the tax reductions are realized and, hence, the higher the net present value of the tax shield. In recent years, tax depreciation has been accelerated to allow write-offs over very short time periods regardless of an asset's expected life. To maximize present value, it is usually best to claim depreciation as rapidly as possible.

The depreciation tax shield affects the net present value analysis in two ways:

- Depreciation tax shield on acquired assets.
- Forgone depreciation tax shield on disposed assets.

Consider the tax depreciation schedule of the new equipment that Mezzo Diner is evaluating. It has a depreciation tax basis of \$500,000 over five years. This is computed as the outlay cost of the equipment (\$600,000) less the estimated disposal or salvage value of \$100,000. The equipment is assumed to have a five-year life for tax purposes, so using straight-line depreciation, annual depreciation on the equipment is \$100,000 (= \$500,000 ÷ 5 years). (All amounts given in this text are for illustrative purposes only. They do not necessarily reflect the amount of depreciation allowed by the tax regulations, which varies by type of asset and often changes as Congress passes new "tax reforms.") As a result of depreciation expense, Mezzo's tax payment will be lower by \$40,000 (= \$100,000 × 40% tax rate) every year. It is important to note that the depreciation expense itself is not included in the analysis. It is not a cash expense. (More important, we have already included the cost of the equipment in the initial outlay. To include the depreciation expense would be to double-count the equipment cost.)

Disinvestment Cash Flows

disinvestment flows Cash flows that take place at the termination of a capital project.

Cash flows at the end of the life of the project are called **disinvestment flows.** The end of a project's life usually results in some or all of the following cash flows:

- Cash freed from working capital commitments (now as cash inflow).
- Salvage of the long-term assets (usually a cash inflow unless there are disposal costs).
- Tax consequences for differences between salvage proceeds and the remaining depreciation tax basis of the asset.
- Other cash flows, such as employee severance payments and restoration costs.

Return of Working Capital When a project ends, some inventory, cash, and other working capital items that were used to support operations are usually left over. These working capital items are then freed for use elsewhere or are liquidated for cash. Therefore, at the end of a project's life, the return of these working capital items is shown as a cash inflow. In the example of Mezzo Diner, it will have \$120,000 in working capital available for other uses, which is the money it put in the bank to facilitate cash transactions.

It is important not to double-count these items. Suppose that cash collected from a customer was already recorded as a cash inflow to the company, but it was left in the project's bank account until the end of the project's life. It should not be counted again as a cash inflow at the project's end.

The return of working capital is recorded as an inflow when it is freed for use in other organizational activities. If that does not occur until the end of the project's life, the cash inflow is included as part of disinvestment flows.

Salvage of Long-Term Assets Ending a project often includes the disposal of its assets. These are usually sold in secondhand markets. In some cases, more money can be spent disassembling the assets and disposing of them than their sale gains. Any net outflows from the disposal of a project's assets become tax deductions in the year of disposal. The *net salvage value* (sometimes negative) of an asset is listed as a cash inflow or outflow at the time it is expected to be realized (or incurred), regardless of its book value or **tax basis.** The difference between the book value (tax basis) and the net salvage value can result in a taxable gain or loss.

tax basis Remaining tax-depreciable "book value" of an asset for tax purposes.

For an asset replacement decision, the forgone salvage value (and related tax effects) from the old asset must also be considered. For example, assume that "asset new" replaced "asset old" for the next five years. Asset old could be sold for \$2,000 at the end of five years; asset new could be sold for \$10,000 at the end of five years. If asset new replaces asset old, the \$8,000 incremental salvage value should be the disinvestment cash flow for the analysis. Any additional taxes paid (or tax payments reduced) because we are salvaging asset new instead of asset old should be included in the analysis.

Tax Consequences of Disposal Any difference between the tax basis of a project's assets (generally, the undepreciated balance) and the amount realized from project disposal results in a tax gain or loss. Therefore, a company's tax liability is affected in the year of disposal. Tax laws on asset dispositions are complex, so tax advice should be sought well in advance of the proposed disposal date. Here, we assume that any gains or losses on disposal are treated as ordinary taxable income or losses.

Suppose that an asset is carried in the financial accounting records at a net book value of \$80,000 and is salvaged for \$30,000 cash. The tax basis of the asset is \$10,000, and the tax rate is 40 percent. What are the cash flows from disposal of this asset?

First, the company receives the $30,000 as a cash inflow. Second, it reports a $20,000 taxable gain, which is the difference between the $30,000 cash inflow and the $10,000 tax basis. This $20,000 gain is taxed at 40 percent, resulting in an $8,000 cash outflow. The net-of-tax cash inflow on disposal is $22,000, the net of the $30,000 inflow and the $8,000 cash outflow, as follows:

Cash inflow	$30,000
Tax payment	
($30,000 cash inflow − $10,000 tax basis) × 40% tax rate	(8,000)
Net-of-tax cash inflow	$22,000

Mezzo Diner plans to dispose of the equipment for $100,000, the disposal value in Exhibit A.1. Because this is the amount included when computing depreciation, there is no loss or gain on the disposition and, therefore, no tax effect.

Other Disinvestment Flows The end of project operations can result in a number of costs not directly related to the sale of assets. It could be necessary to make severance payments to employees. Sometimes payments are required to restore the project area to its original condition. Some projects incur regulatory costs when they are closed. A cost analyst must inquire about the consequences of disposal to determine the costs that should be included in the disinvestment flows for a project.

Preparing the Net Present Value Analysis

As soon as the cash flow data have been gathered, they are assembled into a schedule that shows the cash flows for each year of the project's life. These flows can be classified into the four categories just discussed:

- Investment cash flows.
- Periodic operating cash flows.
- Cash flows from the depreciation tax shield.
- Disinvestment cash flows.

A summary schedule that shows the total of the annual cash flows and the net present value of the project is prepared. This summary can be supported by as much detail as management deems necessary for making the investment decision.

Exhibit A.2 contains the analysis for the investment decision for Mezzo Diner. The project is expected to earn more than the 12 percent used to discount the cash flows because the net present value of the project is higher than zero. (If the net present value of the project had been less than zero, the project would have been expected to earn less than the 12 percent used to discount the cash flows.)

The positive net present value of the project ($46,430) is computed as the sum of the present values of each year's cash flows.

Using Microsoft Excel to Prepare the Net Present Value Analysis

The computations shown in Exhibit A.2 illustrate how to compute net present values using the present value factors in Exhibit A.8. However, these calculations are built-in functions in Excel, so there is no reason to compute (or enter) individual present value factors. We illustrate in the series of exhibits below how to complete this calculation using Excel directly.

Exhibit A.2 Cash Flow Schedule with Present Value Computations—Mezzo Diner

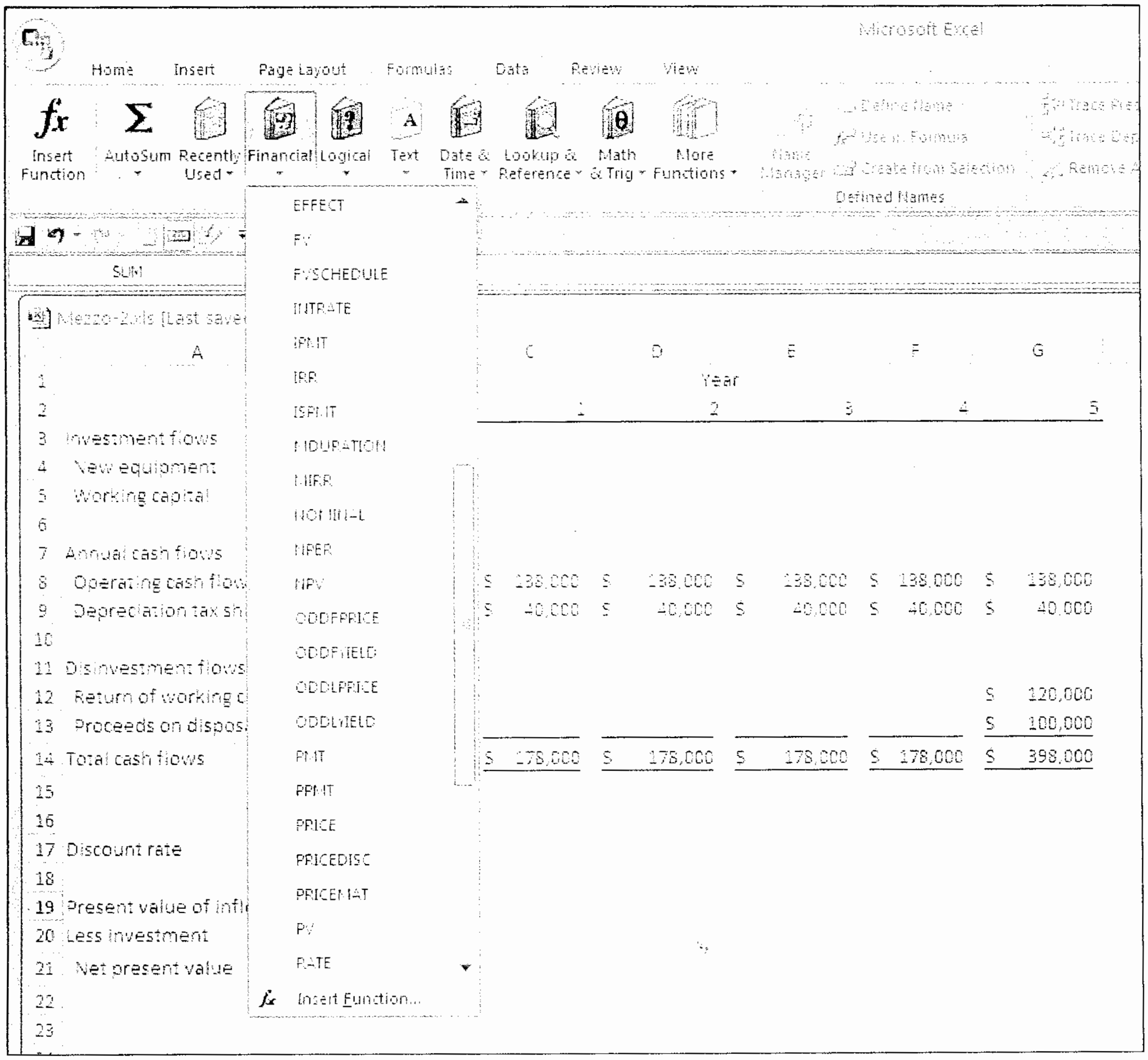
	A	B	C	D	E	F	G
7	Annual cash flows						
8	Operating cash flows		$ 138,000	$ 138,000	$ 138,000	$ 138,000	$ 138,000
9	Depreciation tax shield		$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000
10							
11	Disinvestment flows						
12	Return of working capital						$ 120,000
13	Proceeds on disposal						$ 100,000
14	Total cash flows	$ (720,000)	$ 178,000	$ 178,000	$ 178,000	$ 178,000	$ 398,000
15	Present value factor @12%[a]	1	0.893	0.797	0.712	0.636	0.567
16							
17	Present values	$ (720,000)	$ 158,954	$ 141,866	$ 126,736	$ 113,208	$ 225,666
18							
19	Net present value	$ 46,430					
20							
21	[a]Present value factor shown is rounded to three places. Present value factors are shown in Exhibit A.8.						
22							
23							

The first step is to modify the spreadsheet slightly to remove the present value factors and set up the Excel calculation. The basic spreadsheet is shown in Exhibit A.3. In addition to removing the rows with the present value factors, we have introduced some new cells: one with the discount rate; one for the computation of the present value of the cash inflows; one with the initial investment amount; and one for the computation of the net present value.

Exhibit A.3 Spreadsheet for Calculation of Net Present Value Using Microsoft Excel

	A	B	C	D	E	F	G
1				Year			
2		0	1	2	3	4	5
3	Investment flows	$ (600,000)					
4	New equipment	$ (120,000)					
5	Working capital						
6							
7	Annual cash flows						
8	Operating cash flows		$ 138,000	$ 138,000	$ 138,000	$ 138,000	$ 138,000
9	Depreciation tax shield		$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000
10							
11	Disinvestment flows						
12	Return of working capital						$ 120,000
13	Proceeds on disposal						$ 100,000
14	Total cash flows	$ (720,000)	$ 178,000	$ 178,000	$ 178,000	$ 178,000	$ 398,000
15							
16							
17	Discount rate	12%					
18							
19	Present value of inflows						
20	Less investment	$ (720,000)					
21	Net present value						
22							

Exhibit A.4 Insert-Function Dialog Box

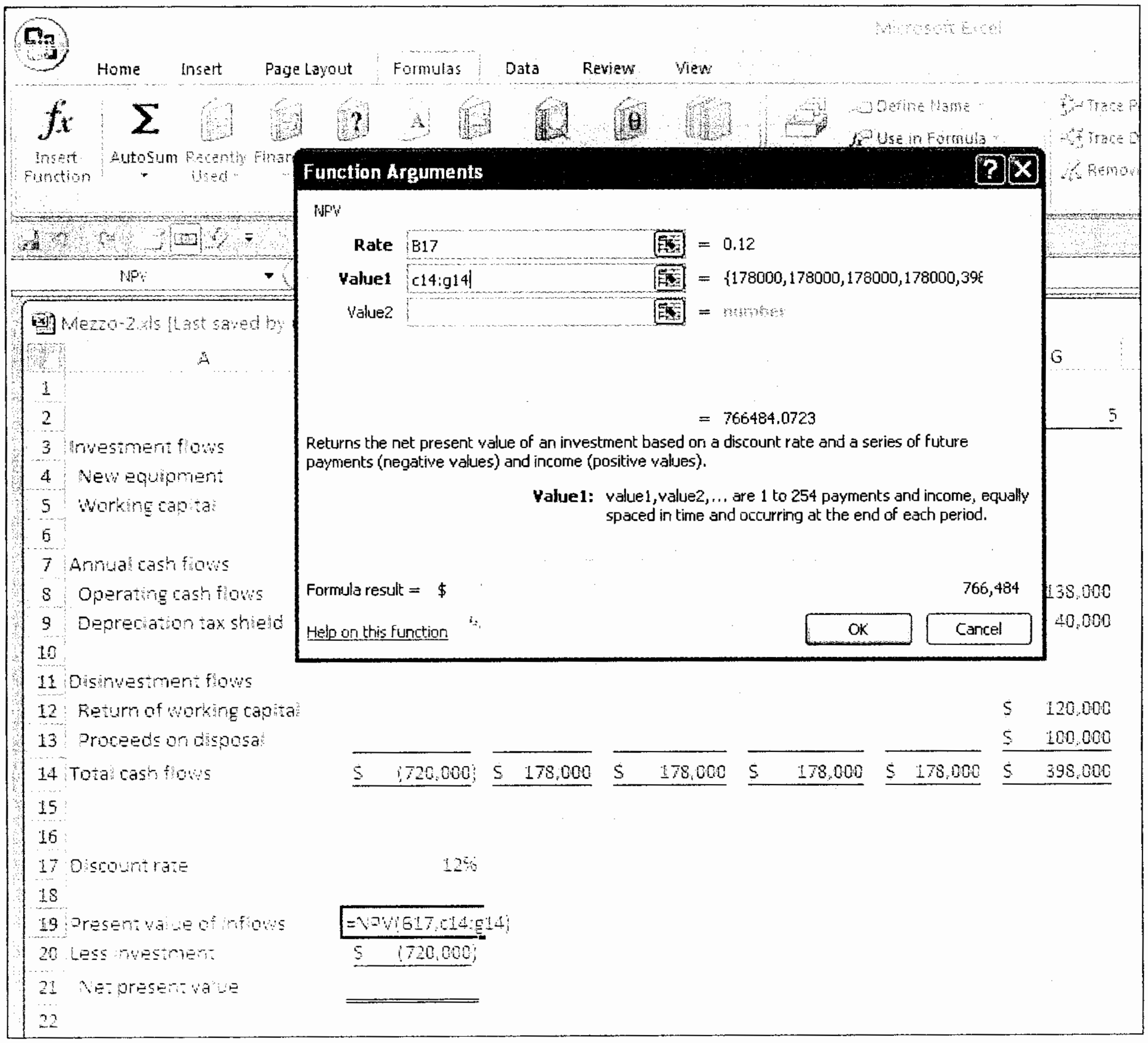


The first step is to select the cell (B19) where the present value of the cash inflows for periods one through five will be computed. (Because the Excel function we use assumes that all cash flows occur at the end of the period, we have to compute the present value of the cash inflows and then subtract the initial cash investment.)

After selecting cell B19, select the net present value function. This is a built-in function in Excel that you can access as follows. On the ribbon, select the formula tab. This will reveal a set of "books" containing different types of formulas in the "library." Click on the "Financial" book. This will show a drop-down list of formulas. Scroll down and select "NPV" as shown in Exhibit A.4.

A new dialog box will open as shown in Exhibit A.5. This dialog box will ask for two types of inputs. First, enter (or point to the cell with) the discount rate. Click on the box labeled "Rate" and either enter the rate (12%) or point to the cell with the rate (B17). (Notice how choosing cell B17 results in the rate (12%) being displayed to the right of the box.) Next, point to the input box labeled "Value1" and enter or point to the range with the cash inflows (C14:G14). (To enter the range, select C14

Exhibit A.5 Enter the Data for the Calculation



and then, holding down the left mouse button, drag the cursor across the range, stopping at cell G14.)

Once the two boxes are complete, select "OK." The present value of the cash flows will appear in the cell. This is shown in Exhibit A.6. Note two things:

1. The format of the cell might not match the formatting of the other cells (for example, the present value might be displayed with two decimal places).
2. There might be an error indicator that appears. In this case, the "error" is that an adjacent cell was not used (and should not have been used). It is possible to turn this off, but, as it is the default operation, we have left it on.

Finally, we subtract the initial investment (add the negative initial cash flow) to obtain the net present value. This is shown in Exhibit A.7. (Note that we have formatted the cell to be consistent with the rest of the spreadsheet.) The resulting net present value of \$46,484 differs from what we calculated using the net present value factors (\$46,430) because the net present value factors have been rounded to three decimal places.

Exhibit A.6 Results of the Present Value Calculation

	A	B	C	D	E	F	G
1				Year			
2		0	1	2	3	4	5
3	Investment flows						
4	New equipment	$ (600,000)					
5	Working capital	$ (120,000)					
6							
7	Annual cash flows						
8	Operating cash flows		$ 138,000	$ 138,000	$ 138,000	$ 138,000	$ 138,000
9	Depreciation tax shield		$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000
10							
11	Disinvestment flows						
12	Return of working capital						$ 120,000
13	Proceeds on disposal						$ 100,000
14	Total cash flows	$ (720,000)	$ 178,000	$ 178,000	$ 178,000	$ 178,000	$ 398,000
15							
16							
17	Discount rate	12%					
18							
19	Present value of inflows	$ 766,484					
20	Less investment	$ (720,000)					
21	Net present value						
22							

Exhibit A.7 The Net Present Value of the Investment

	A	B	C	D	E	F	G
1				Year			
2		0	1	2	3	4	5
3	Investment flows						
4	New equipment	$ (600,000)					
5	Working capital	$ (120,000)					
6							
7	Annual cash flows						
8	Operating cash flows		$ 138,000	$ 138,000	$ 138,000	$ 138,000	$ 138,000
9	Depreciation tax shield		$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000
10							
11	Disinvestment flows						
12	Return of working capital						$ 120,000
13	Proceeds on disposal						$ 100,000
14	Total cash flows	$ (720,000)	$ 178,000	$ 178,000	$ 178,000	$ 178,000	$ 398,000
15							
16							
17	Discount rate	12%					
18							
19	Present value of inflows	$ 766,484					
20	Less investment	$ (720,000)					
21	Net present value	$ 46,484					
22							

Self-Study Question

1. Nu-Concepts, Inc., a southeastern advertising agency, is considering the purchase of new computer equipment and software to enhance its graphics capabilities. Management has been considering several alternative systems, and a local vendor has submitted a quote to the company of $15,000 for the equipment plus $16,800 for software. Assume that the equipment can be depreciated for tax purposes over three years as follows: year 1, $5,000; year 2, $5,000; year 3, $5,000. The software can be written off immediately for tax purposes. The company expects to use the new machine for four years and to use straight-line depreciation for financial reporting purposes. The market for used computer systems is such that Nu-Concepts could sell the equipment for $2,000 at the end of four years. The software would have no salvage value at that time.

   Nu-Concepts management believes that introduction of the computer system will enable the company to dispose of its existing equipment, which is fully depreciated for tax purposes. It can be sold for an estimated $200 but would have no salvage value in four years. If Nu-Concepts does not buy the new equipment, it would continue to use the old graphics system for four more years.

   Management believes that it will realize improvements in operations and benefits from the computer system worth $16,000 per year before taxes.

   Nu-Concepts uses a 10 percent discount rate for this investment and has a marginal income tax rate of 40 percent after considering both state federal taxes.

   a. Prepare a schedule showing the relevant cash flows for the project.

   b. Indicate whether the project has a positive or negative net present value.

The solution to this question is at the end of the appendix on page A-16.

Exhibit A.8 Present Value of $1

Year	5%	6%	8%	10%	12%	14%	15%	16%	18%	20%
1.....	0.952	0.943	0.926	0.909	0.893	0.877	0.870	0.862	0.847	0.833
2.....	0.907	0.890	0.857	0.826	0.797	0.769	0.756	0.743	0.718	0.694
3.....	0.864	0.840	0.794	0.751	0.712	0.675	0.658	0.641	0.609	0.579
4.....	0.823	0.792	0.735	0.683	0.636	0.592	0.572	0.552	0.516	0.482
5.....	0.784	0.747	0.681	0.621	0.567	0.519	0.497	0.476	0.437	0.402
6.....	0.746	0.705	0.630	0.564	0.507	0.456	0.432	0.410	0.370	0.335
7.....	0.711	0.665	0.583	0.513	0.452	0.400	0.376	0.354	0.314	0.279
8.....	0.677	0.627	0.540	0.467	0.404	0.351	0.327	0.305	0.266	0.233
9.....	0.645	0.592	0.500	0.424	0.361	0.308	0.284	0.263	0.225	0.194
10.....	0.614	0.558	0.463	0.386	0.322	0.270	0.247	0.227	0.191	0.162
11.....	0.585	0.527	0.429	0.350	0.287	0.237	0.215	0.195	0.162	0.135
12.....	0.557	0.497	0.397	0.319	0.257	0.208	0.187	0.168	0.137	0.112
13.....	0.530	0.469	0.368	0.290	0.229	0.182	0.163	0.145	0.116	0.093
14.....	0.505	0.442	0.340	0.263	0.205	0.160	0.141	0.125	0.099	0.078
15.....	0.481	0.417	0.315	0.239	0.183	0.140	0.123	0.108	0.084	0.065

Year	22%	24%	25%	26%	28%	30%	32%	34%	35%	40%
1.....	0.820	0.806	0.800	0.794	0.781	0.769	0.758	0.746	0.741	0.714
2.....	0.672	0.650	0.640	0.630	0.610	0.592	0.574	0.557	0.549	0.510
3.....	0.551	0.524	0.512	0.500	0.477	0.455	0.435	0.416	0.406	0.364
4.....	0.451	0.423	0.410	0.397	0.373	0.350	0.329	0.310	0.301	0.260
5.....	0.370	0.341	0.328	0.315	0.291	0.269	0.250	0.231	0.223	0.186
6.....	0.303	0.275	0.262	0.250	0.227	0.207	0.189	0.173	0.165	0.133
7.....	0.249	0.222	0.210	0.198	0.178	0.159	0.143	0.129	0.122	0.095
8.....	0.204	0.179	0.168	0.157	0.139	0.123	0.108	0.096	0.091	0.068
9.....	0.167	0.144	0.134	0.125	0.108	0.094	0.082	0.072	0.067	0.048
10.....	0.137	0.116	0.107	0.099	0.085	0.073	0.062	0.054	0.050	0.035
11.....	0.112	0.094	0.086	0.079	0.066	0.056	0.047	0.040	0.037	0.025
12.....	0.092	0.076	0.069	0.062	0.052	0.043	0.036	0.030	0.027	0.018
13.....	0.075	0.061	0.055	0.050	0.040	0.033	0.027	0.022	0.020	0.013
14.....	0.062	0.049	0.044	0.039	0.032	0.025	0.021	0.017	0.015	0.009
15.....	0.051	0.040	0.035	0.031	0.025	0.020	0.016	0.012	0.011	0.006

Exhibit A.9 Present Value of an Annuity of $1

Year	5%	6%	8%	10%	12%	14%	15%	16%	18%	20%
1	0.952	0.943	0.926	0.909	0.893	0.877	0.870	0.862	0.847	0.833
2	1.859	1.833	1.783	1.736	1.690	1.647	1.626	1.605	1.566	1.528
3	2.723	2.673	2.577	2.487	2.402	2.322	2.283	2.246	2.174	2.106
4	3.546	3.465	3.312	3.170	3.037	2.914	2.855	2.798	2.690	2.589
5	4.329	4.212	3.993	3.791	3.605	3.433	3.352	3.274	3.127	2.991
6	5.076	4.917	4.623	4.355	4.111	3.889	3.784	3.685	3.498	3.326
7	5.786	5.582	5.206	4.868	4.564	4.288	4.160	4.039	3.812	3.605
8	6.463	6.210	5.747	5.335	4.968	4.639	4.487	4.344	4.078	3.837
9	7.108	6.802	6.247	5.759	5.328	4.946	4.772	4.607	4.303	4.031
10	7.722	7.360	6.710	6.145	5.650	5.216	5.019	4.833	4.494	4.192
11	8.306	7.887	7.139	6.495	5.938	5.453	5.234	5.029	4.656	4.327
12	8.863	8.384	7.536	6.814	6.194	5.660	5.421	5.197	4.793	4.439
13	9.394	8.853	7.904	7.103	6.424	5.842	5.583	5.342	4.910	4.533
14	9.899	9.295	8.244	7.367	6.628	6.002	5.724	5.468	5.008	4.611
15	10.380	9.712	8.559	7.606	6.811	6.142	5.847	5.575	5.092	4.675

Year	22%	24%	25%	26%	28%	30%	32%	34%	35%	40%
1	0.820	0.806	0.800	0.794	0.781	0.769	0.758	0.746	0.741	0.714
2	1.492	1.457	1.440	1.424	1.392	1.361	1.331	1.303	1.289	1.224
3	2.042	1.981	1.952	1.923	1.868	1.816	1.766	1.719	1.696	1.589
4	2.494	2.404	2.362	2.320	2.241	2.166	2.096	2.029	1.997	1.849
5	2.864	2.745	2.689	2.635	2.532	2.436	2.345	2.260	2.220	2.035
6	3.167	3.020	2.951	2.885	2.759	2.643	2.534	2.433	2.385	2.168
7	3.416	3.242	3.161	3.083	2.937	2.802	2.677	2.562	2.508	2.263
8	3.619	3.421	3.329	3.241	3.076	2.925	2.786	2.658	2.598	2.331
9	3.786	3.566	3.463	3.366	3.184	3.019	2.868	2.730	2.665	2.379
10	3.923	3.682	3.571	3.465	3.269	3.092	2.930	2.784	2.715	2.414
11	4.035	3.776	3.656	3.543	3.335	3.147	2.978	2.824	2.752	2.438
12	4.127	3.851	3.725	3.606	3.387	3.190	3.013	2.853	2.779	2.456
13	4.203	3.912	3.780	3.656	3.427	3.223	3.040	2.876	2.799	2.469
14	4.265	3.962	3.824	3.695	3.459	3.249	3.061	2.892	2.814	2.478
15	4.315	4.001	3.859	3.726	3.483	3.268	3.076	2.905	2.825	2.484

Key Terms

asset acquisition, *A-4*
discount rate, *A-2*
disinvestment flows, *A-6*
investment tax credit (ITC), *A-4*
net present value (NPV), *A-2*
present value, *A-2*
tax basis, *A-6*
tax shield, *A-5*
time value of money, *A-1*
working capital, *A-4*

Review Questions

A-1. What are the two most important factors an accountant must estimate in the capital investment decision?

A-2. What does the *time value of money* mean?

A-3. What is the difference between revenues and cash inflows?

A-4. What is the difference between expenses and cash outflows?

A-5. What is the difference between depreciation and the tax shield on depreciation?

Critical Analysis and Discussion Questions

A-6. Given two projects with equal cash flows but different timing, how can we determine which (if either) project should be selected for investment?

A-7. What are the four types of cash flows related to a capital investment project and why do we consider them separately?

A-8. Is depreciation included in the computation of net present value? Explain.

A-9. "The total tax deduction for depreciation is the same over the life of the project regardless of depreciation method. Why then would one be concerned about the depreciation method for capital investment analysis?" Comment.

A-10. "Working capital is just the temporary use of money during the life of the project. What is initially contributed is returned at the end, so it can be ignored in evaluating a project." Comment.

Exercises

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A-11. Present Value of Cash Flows

Star City is considering an investment in the community center that is expected to return the following cash flows:

Year	Net Cash Flow
1	$ 20,000
2	50,000
3	80,000
4	80,000
5	100,000

This schedule includes all cash inflows from the project, which will also require an immediate $180,000 cash outlay. The city is tax-exempt; therefore, taxes need not be considered.

Required

a. What is the net present value of the project if the appropriate discount rate is 20 percent?

b. What is the net present value of the project if the appropriate discount rate is 12 percent?

A-12. Present Value of Cash Flows

Rush Corporation plans to acquire production equipment for $600,000 that will be depreciated for tax purposes as follows: year 1, $120,000; year 2, $210,000; and in each of years 3 through 5, $90,000 per year. An 8 percent discount rate is appropriate for this asset, and the company's tax rate is 40 percent.

Required

a. Compute the present value of the tax shield resulting from depreciation.

b. Compute the present value of the tax shield from depreciation assuming straight-line depreciation ($120,000 per year).

A-13. Present Value Analysis in Nonprofit Organizations

The Johnson Research Organization, a nonprofit organization that does not pay taxes, is considering buying laboratory equipment with an estimated life of seven years so it will not have to use outsiders' laboratories for certain types of work. The following are all of the cash flows affected by the decision:

Investment (outflow at time 0)	$6,000,000
Periodic operating cash flows:	
Annual cash savings because outside laboratories are not used	1,400,000
Additional cash outflow for people and supplies to operate the equipment	200,000
Salvage value after seven years, which is the estimated life of this project	400,000
Discount rate	10%

Required
Calculate the net present value of this decision. (Refer to Exhibit A.2 in formatting your answer.) Should the organization buy the equipment?

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Problems

A-14. Sensitivity Analysis in Capital Investment Decisions
Square Manufacturing is considering investing in a robotics manufacturing line. Installation of the line will cost an estimated $4.5 million. This amount must be paid immediately even though construction will take three years to complete (years 0, 1, and 2). Year 3 will be spent testing the production line and, hence, it will not yield any positive cash flows. If the operation is very successful, the company can expect after-tax cash savings of $3 million per year in each of years 4 through 7. After reviewing the use of these systems with the management of other companies, Square's controller has concluded that the operation will most probably result in annual savings of $2,100,000 per year for each of years 4 through 7. However, it is entirely possible that the savings could be as low as $900,000 per year for each of years 4 through 7. The company uses a 14 percent discount rate.

Required
Compute the NPV under the three scenarios.

A-15. Compute Net Present Value
Dungan Corporation is evaluating a proposal to purchase a new drill press to replace a less efficient machine presently in use. The cost of the new equipment at time 0, including delivery and installation, is $200,000. If it is purchased, Dungan will incur costs of $5,000 to remove the present equipment and revamp its facilities. This $5,000 is tax deductible at time 0.

Depreciation for tax purposes will be allowed as follows: year 1, $40,000; year 2, $70,000; and in each of years 3 through 5, $30,000 per year. The existing equipment has a book and tax value of $100,000 and a remaining useful life of 10 years. However, the existing equipment can be sold for only $40,000 and is being depreciated for book and tax purposes using the straight-line method over its actual life.

Management has provided you with the following comparative manufacturing cost data:

	Present Equipment	New Equipment
Annual capacity (units)	400,000	400,000
Annual costs:		
Labor	$30,000	$25,000
Depreciation	10,000	14,000
Other (all cash)	48,000	20,000
Total annual costs	$88,000	$59,000

The existing equipment is expected to have a salvage value equal to its removal costs at the end of 10 years. The new equipment is expected to have a salvage value of $60,000 at the end of 10 years, which will be taxable, and no removal costs. No changes in working capital are required with the purchase of the new equipment. The sales force does not expect any changes in the volume of sales over the next 10 years. The company's cost of capital is 16 percent, and its tax rate is 40 percent.

Required

a. Calculate the removal costs of the existing equipment net of tax effects.

b. Compute the depreciation tax shield.

c. Compute the forgone tax benefits of the old equipment.

d. Calculate the cash inflow, net of taxes, from the sale of the new equipment in year 10.

e. Calculate the tax benefit arising from the loss on the old equipment.

f. Compute the annual differential cash flows arising from the investment in years 1 through 10.

g. Compute the net present value of the project.

Solution to Self-Study Question

1. *a.* and *b.*

	Year 0	1	2	3	4
Investment flows					
New equipment	$(15,000)				
Software ($16,800 × 60%)[a]	(10,080)				
Old equipment ($200 × 60%)	120				
Annual cash flows ($16,000 × 60%)		$ 9,600	$ 9,600	$ 9,600	$ 9,600
Depreciation tax shield ($5,000 × 40%)		2,000	2,000	2,000	
Disinvestment flows ($2,000 × 60%)					1,200
Total cash flows	$(24,960)	$11,600	$11,600	$11,600	$10,800
Present value factor at 10%	1.000	0.909	0.826	0.751	0.683
Present values[b]	$(24,960)	$10,544	$9,582	$8,712	$7,376
Net present value	$ 11,254				

[a]60% = 1 − 40% tax rate, which converts before-tax flows to after-tax flows.

[b]Present value factor shown is rounded to three places. Present value factors are shown in Exhibit A.8.