



APPENDIX

11A

DEPRECIATION

Suppose a firm buys a milling machine for \$100,000 and uses it for five years, after which it is scrapped. The cost of the goods produced by the machine must include a charge for the machine, and this charge is called *depreciation*. In the following sections, we review some of the depreciation concepts covered in accounting courses.

Companies often calculate depreciation one way when figuring taxes and another way when reporting income to investors: many use the *straight-line* method for stockholder reporting (or “book” purposes), but they use the fastest rate permitted by law for tax purposes. Under the straight-line method used for stockholder reporting, one normally takes the cost of the asset, subtracts its estimated salvage value, and divides the net amount by the asset’s useful economic life. For an asset with a 5-year life, which costs \$100,000 and has a \$12,500 salvage value, the annual straight-line depreciation charge is $(\$100,000 - \$12,500)/5 = \$17,500$. Note, however, as we discuss later in this appendix, that salvage value is *not* considered for tax depreciation purposes.

For tax purposes, Congress changes the permissible tax depreciation methods from time to time. Prior to 1954, the straight-line method was required for tax purposes, but in 1954 *accelerated* methods (double-declining balance and sum-of-years’-digits) were permitted. Then, in 1981, the old accelerated methods were replaced by a simpler procedure known as the Accelerated Cost Recovery System (ACRS). The ACRS system was changed again in 1986 as a part of the Tax Reform Act, and it is now known as the *Modified Accelerated Cost Recovery System (MACRS)*; a 1993 tax law made further changes in this area.

Note that U.S. tax laws are very complicated, and in this appendix we can only provide an overview of MACRS designed to give you a basic understanding of the impact of depreciation on capital budgeting decisions. Further, the tax laws change so often that the numbers we present may be outdated before the book is even published. Thus, when dealing with tax depreciation in real-world situations, current Internal Revenue Service (IRS) publications or individuals with expertise in tax matters should be consulted.

TAX DEPRECIATION LIFE

For tax purposes, the entire cost of an asset is expensed over its depreciable life. Historically, an asset’s depreciable life was determined by its estimated useful economic life; it was intended that an asset would be fully depreciated at approximately the same time that it reached the end of its useful economic life. However, MACRS totally abandoned that practice and set simple guidelines that created several classes of assets, each with a more-or-less arbitrarily prescribed life called a *recovery period* or *class life*. The MACRS class life bears only a rough relationship to the expected useful economic life.

A major effect of the MACRS system has been to shorten the depreciable lives of assets, thus giving businesses larger tax deductions and thereby increasing their cash flows available for investment. Table 11A-1 describes the types of property that fit

TABLE 11A-1

Major Classes and Asset Lives for MACRS

CLASS	TYPE OF PROPERTY
3-year	Certain special manufacturing tools
5-year	Automobiles, light-duty trucks, computers, and certain special manufacturing equipment
7-year	Most industrial equipment, office furniture, and fixtures
10-year	Certain longer-lived types of equipment
27.5-year	Residential rental real property such as apartment buildings
39-year	All nonresidential real property, including commercial and industrial buildings

into the different class life groups, and Table 11A-2 sets forth the MACRS recovery allowance percentages (depreciation rates) for selected classes of investment property.

Consider Table 11A-1 first. The first column gives the MACRS class life, while the second column describes the types of assets that fall into each category. Property in the 27.5- and 39-year categories (real estate) must be depreciated by the straight-line method, but 3-, 5-, 7-, and 10-year property (personal property) can be depreciated either by the accelerated method using the rates shown in Table 11A-2 or by an alternate straight-line method.¹

As we saw earlier in the chapter, higher depreciation expenses result in lower taxes, hence higher cash flows. Therefore, since a firm has the choice of using the alternate straight-line rates or the accelerated rates shown in Table 11A-2, most elect to use the accelerated rates.

The yearly recovery allowance, or depreciation expense, is determined by multiplying each asset's *depreciable basis* by the applicable recovery percentage shown in Table 11A-2. Calculations are discussed in the following sections.

Half-Year Convention

Under MACRS, the assumption is generally made that property is placed in service in the middle of the first year. Thus, for 3-year class life property, the recovery period begins in the middle of the year the asset is placed in service and ends three years later. The effect of the *half-year convention* is to extend the recovery period out one more year, so 3-year class life property is depreciated over four calendar years, 5-year property is depreciated over six calendar years, and so on. This convention is incorporated into Table 11A-2's recovery allowance percentages.²

¹ As a benefit to very small companies, the Tax Code also permits companies to *expense*, which is equivalent to depreciating over one year, up to \$24,000 for 2002 and \$25,000 for 2003 and thereafter. Thus, if a small company bought one asset worth up to \$20,000, it could write the asset off in the year it was acquired. This is called "Section 179 expensing." We shall disregard this provision throughout the book.

² The half-year convention also applies if the straight-line alternative is used, with half of one year's depreciation taken in the first year, a full year's depreciation taken in each of the remaining years of the asset's class life, and the remaining half-year's depreciation taken in the year following the end of the class life. You should recognize that virtually all companies have computerized depreciation systems. Each asset's depreciation pattern is programmed into the system at the time of its acquisition, and the computer aggregates the depreciation allowances for all assets when the accountants close the books and prepare financial statements and tax returns.

TABLE 11A-2

Recovery Allowance Percentage for Personal Property

OWNERSHIP YEAR	CLASS OF INVESTMENT			
	3-YEAR	5-YEAR	7-YEAR	10-YEAR
1	33%	20%	14%	10%
2	45	32	25	18
3	15	19	17	14
4	7	12	13	12
5		11	9	9
6		6	9	7
7			9	7
8			4	7
9				7
10				6
11				3
	100%	100%	100%	100%

NOTES:

- a. We developed these recovery allowance percentages based on the 200 percent declining balance method prescribed by MACRS, with a switch to straight-line depreciation at some point in the asset's life. For example, consider the 5-year recovery allowance percentages. The straight line percentage would be 20 percent per year, so the 200 percent declining balance multiplier is $2.0(20\%) = 40\% = 0.4$. However, because the half-year convention applies, the MACRS percentage for Year 1 is 20 percent. For Year 2, there is 80 percent of the depreciable basis remaining to be depreciated, so the recovery allowance percentage is $0.4(80\%) = 32\%$. In Year 3, $20\% + 32\% = 52\%$ of the depreciation has been taken, leaving 48%, so the percentage is $0.4(48\%) \approx 19\%$. In Year 4, the percentage is $0.4(29\%) \approx 12\%$. After 4 years, straight-line depreciation exceeds the declining balance depreciation, so a switch is made to straight-line (this is permitted under the law). However, the half-year convention must also be applied at the end of the class life, and the remaining 17 percent of depreciation must be taken (amortized) over 1.5 years. Thus, the percentage in Year 5 is $17\%/1.5 \approx 11\%$, and in Year 6, $17\% - 11\% = 6\%$. Although the tax tables carry the allowance percentages out to two decimal places, we have rounded to the nearest whole number for ease of illustration.
- b. Residential rental property (apartments) is depreciated over a 27.5-year life, whereas commercial and industrial structures are depreciated over 39 years. In both cases, straight-line depreciation must be used. The depreciation allowance for the first year is based, pro rata, on the month the asset was placed in service, with the remainder of the first year's depreciation being taken in the 28th or 40th year.

Depreciable Basis

The *depreciable basis* is a critical element of MACRS because each year's allowance (depreciation expense) depends jointly on the asset's depreciable basis and its MACRS class life. The depreciable basis under MACRS is equal to the purchase price of the asset plus any shipping and installation costs. The basis is *not* adjusted for *salvage value* (which is the estimated market value of the asset at the end of its useful life) regardless of whether accelerated or the alternate straight-line method is used.

Sale of a Depreciable Asset

If a depreciable asset is sold, the sales price (actual salvage value) minus the then-existing undepreciated book value is added to operating income and taxed at the firm's marginal tax rate. For example, suppose a firm buys a 5-year class life asset for \$100,000 and sells it at the end of the fourth year for \$25,000. The asset's book value

is equal to $\$100,000(0.11 + 0.06) = \$100,000(0.17) = \$17,000$. Therefore, $\$25,000 - \$17,000 = \$8,000$ is added to the firm's operating income and is taxed.

Depreciation Illustration

Assume that Allied Food Products buys a \$150,000 machine that falls into the MACRS 5-year class life and places it into service on March 15, 2003. Allied must pay an additional \$30,000 for delivery and installation. Salvage value is not considered, so the machine's depreciable basis is \$180,000. (Delivery and installation charges are included in the depreciable basis rather than expensed in the year incurred.) Each year's recovery allowance (tax depreciation expense) is determined by multiplying the depreciable basis by the applicable recovery allowance percentage. Thus, the depreciation expense for 2003 is $0.20(\$180,000) = \$36,000$, and for 2004 it is $0.32(\$180,000) = \$57,600$. Similarly, the depreciation expense is \$34,200 for 2005, \$21,600 for 2006, \$19,800 for 2007, and \$10,800 for 2008. The total depreciation expense over the six-year recovery period is \$180,000, which is equal to the depreciable basis of the machine.

As noted above, most firms use straight-line depreciation for stockholder reporting purposes but MACRS for tax purposes. *For these firms, for capital budgeting, MACRS should be used.* The reason is that, in capital budgeting, we are concerned with cash flows, not reported income. Since MACRS depreciation is used for taxes, this type of depreciation must be used to determine the taxes that will be assessed against a particular project. Only if the depreciation method used for tax purposes is also used for capital budgeting will the analysis produce accurate cash flow estimates.

PROBLEM

11A-1 Depreciation effects

Cate Rzasa, great-granddaughter of the founder of Rzasa Tile Products and current president of the company, believes in simple, conservative accounting. In keeping with her philosophy, she has decreed that the company shall use alternative straight-line depreciation, based on the MACRS class lives, for all newly acquired assets. Your boss, the financial vice-president and the only nonfamily officer, has asked you to develop an exhibit that shows how much this policy costs the company in terms of market value. Rzasa is interested in increasing the value of the firm's stock because she fears a family stockholder revolt that might remove her from office. For your exhibit, assume that the company spends \$100 million each year on new capital projects, that the projects have on average a 10-year class life, that the company has a 9 percent cost of debt, and that its tax rate is 35 percent. (Hint: Show how much the NPV of projects in an average year would increase if Rzasa used the standard MACRS recovery allowances.)