

1.011 Project Evaluation

TAXES & DEPRECIATION

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1. Depreciation
2. Taxes
3. After-tax cash flows

Why Worry About Taxes & Depreciation?

- Income taxes are large cash flows that cannot be ignored
- Tax credits and depreciation rules are sometimes used to encourage investments and we need to understand how that works
- Depreciation is a non-cash expense that results in reduced tax payments
- After tax results are most meaningful to companies

A VERY General Perspective

Gross Income (i.e. Revenue)

- Expenses
- Depreciation

= **Taxable Income** (Net Income Before Taxes)

- Income Tax

= **Net Income After Taxes** (i.e. Profit)

ROI = Net Income After Tax / (Invest-Deprec)

Accounting rules and tax law determine exactly

how depreciation and taxes affect cash flows.

Depreciation Is an Accounting Mechanism to Transform Investment into Annual Expenses

- Investment is a CASH FLOW but not an EXPENSE
 - ▶ "Expenses" are, in accounting terms, amounts that can be deducted from current income to calculate profit
- Investments simply transform financial assets into another type of capital asset
 - ▶ After making an investment, you presumably have the same capital value you started with
- Depreciation is an EXPENSE but not a CASH FLOW
 - ▶ Depreciation is an ACCOUNTING means of reflecting the consumption of a capital asset as it is used

Possible Ways to View Depreciation

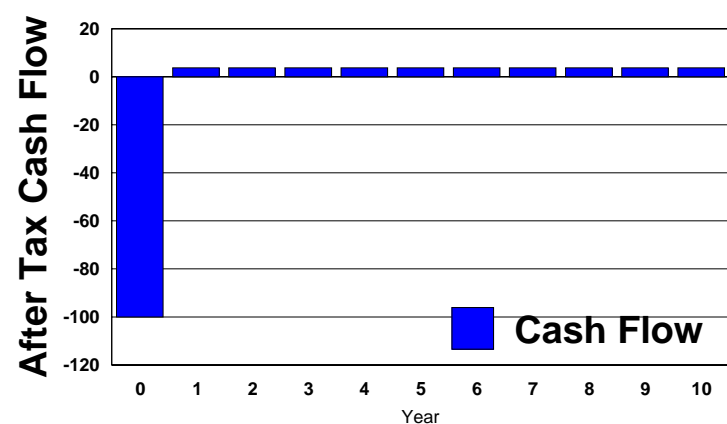
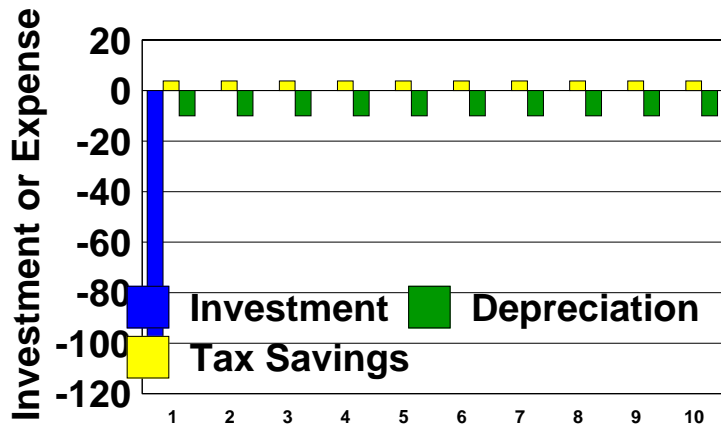
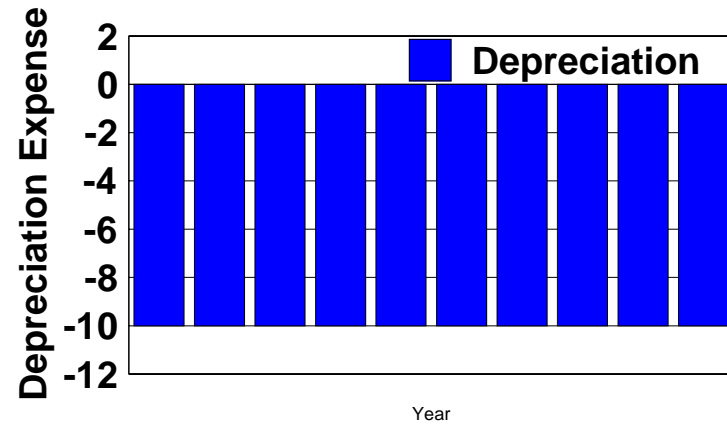
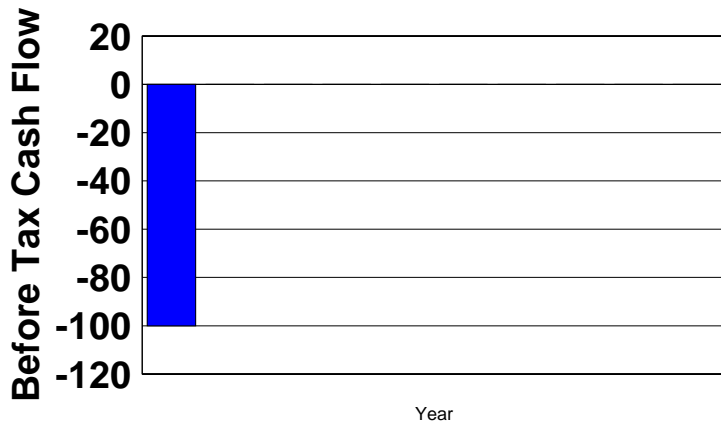
- An **Engineering Estimate** of the decline in capability or loss of value in an asset over time
 - ▶ Use engineering science to determine rate of depreciation (a truck's life is 10 years or 300,000 miles)
- An **Accounting Convention** that translates investment expense into reasonable approximations of actual deterioration or life
 - ▶ Use simplified estimates of lives that reflect actual experience (trucks last 10 years, buildings last 30)
- A **Policy Tool** to promote investment
 - ▶ Allow shorter lives for depreciating housing for the elderly to promote private investment

Depreciation Rules

- The rules will affect profits, net investment (i.e. investment - depreciation), and ROI
 - ▶ *Changes in the rules can therefore change the value of the company or of a project!*
- What can be depreciated
 - ▶ Tangible or intangible assest that are
 - Are used to produce income
 - Have a finite, determinable life > 1 year
 - Deteriorates from use, natural causes or obsolescence
 - Are neither inventory nor stock-in-trade
- Buildings, machinery, vehicles, computers, ...

Cash Flow vs. Accounting Expense:

Accounting Affects the Cash Flows, NPV, etc.



Methods of Depreciation: Policy Concerns

- Simplicity
 - ▶ Engineering formulations can be advanced, but they are complicated for everyone involved
 - ▶ IRS and companies prefer simplicity to realism
- Promote investment by increasing the NPV of the tax break
 - ▶ Shorter asset life
 - ▶ Greater depreciation in early years

Selected Methods of Depreciation

- **Straight-line**

- ▶ Equal depreciation per year over life of asset

- **Declining balance or
Sum-of-the-years-digits**

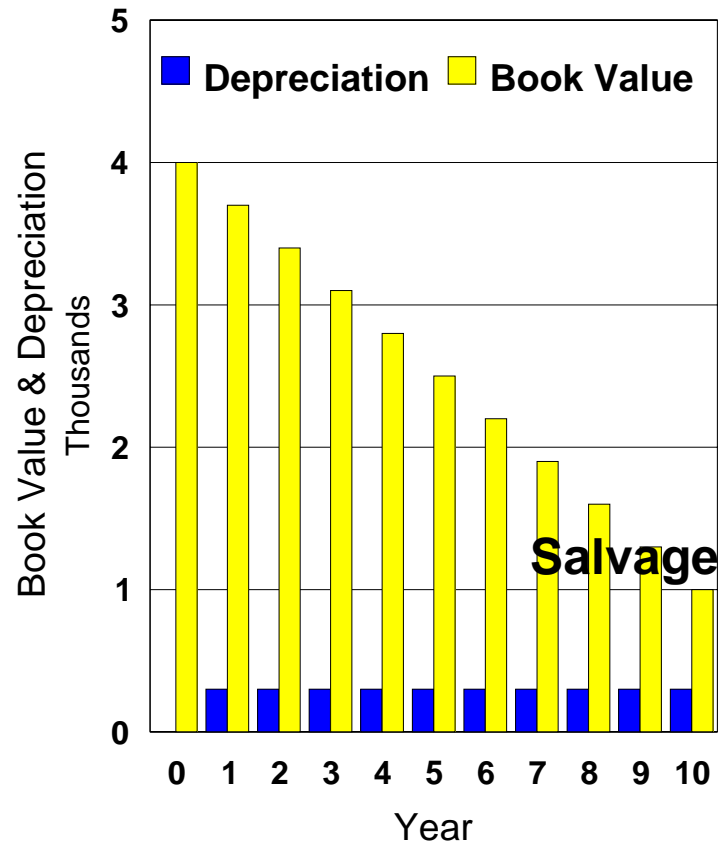
- ▶ More rapid depreciation in early years

- **Modified Accelerated Cost Recovery
System (MACRS)**

- ▶ A limited number of options for useful life
- ▶ Simplify book-keeping

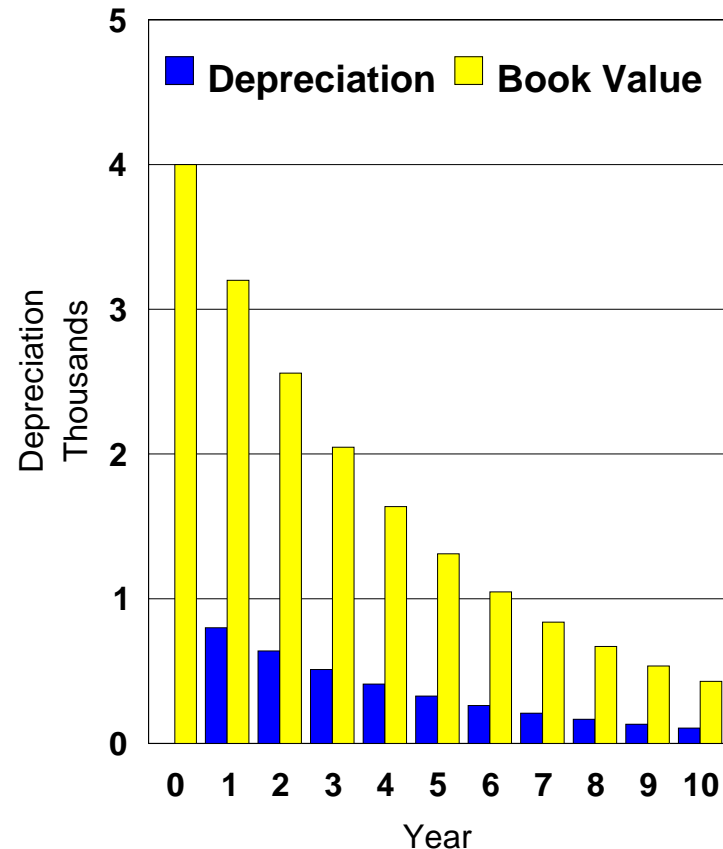
Straight Line Depreciation

- $d_k = (B - S)/N$
- $d_k =$ Deprec. year k
- $B =$ Cost Basis
- $S =$ salvage value
- $N =$ life
- Book value year $k = B - k \cdot d_k$



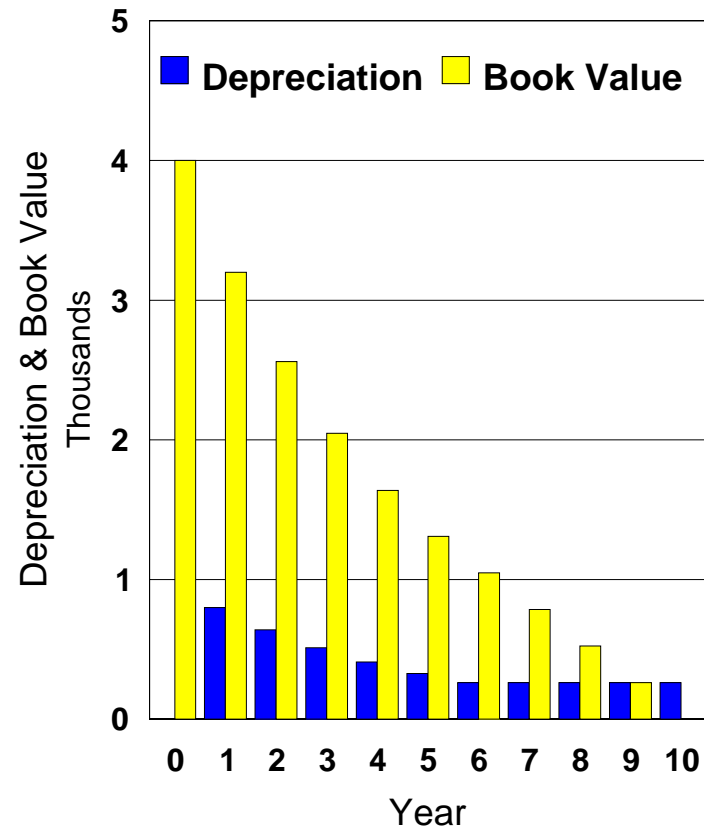
Declining Balance Depreciation

- $d_1 = B \cdot R$
- $d_k = B \cdot (1-R)^{k-1} \cdot R$
- $B = \text{Cost Basis}$
- $BV_k = B \cdot (1-R)^k$
- $BV_N = B \cdot (1-R)^N$
- Salvage value is not included directly
- $R = 1/N$ is straight line
- $R = 2/N$ is double declining balance



Declining Balance Depreciation with Switchover to Straight-Line Method

- Start with double declining balance
- Calculate the annual depreciation for the remaining balance using straight-line method (for the current book value and the remaining life)
- Switch to straight line when that method gives more depreciation



Conventions to Simplify and Unify Depreciation: MACRS

- Modified Accelerated Cost Recovery System introduced by Tax Reform Act of 1986
- Salvage Value assumed to be 0
 - ▶ More depreciation, less record-keeping
- Useful life specified by tax code - one of six categories
 - ▶ Shorter lives, fewer categories, & specified annual percentages OR
 - ▶ ADS (alternative depreciation system), which is straight-line and used for some assets
- First and last year assumed to be exactly 6 months
 - ▶ Don't bother with actual dates

Taxes

Before Tax Cash Flows

+ tax credits - state income tax - fed. income tax
= After Tax Cash Flows

Tax Credits: directly offset tax payments

Income Tax: proportional to income

Federal rate (FR): typically 34% for large US corporations

State rate (SR): typically 6-12% (and deductible from federal tax)

After Tax MARR

Effective income tax rate = $SR + FR(1-SR)$

Example: Eff Inc tax rate = $.1 + .34 * .9 = .406$

After tax MARR = $MARR * (1 - \text{eff inc tax rate})$

Not exact because timing and amount of income vary with depreciation and purchase and disposal of assets.

Depreciation & Taxes: Summary

- Depreciation and taxes are important because they affect cash flows
- Depreciation is based upon accounting rules and the tax code - NOT upon actual physical deterioration
- Accelerated depreciation increase expenses and reduces profit in the early years of a project, but actually increases tax flow by reducing taxes
- Tax credits are equivalent to a reduction in the investment
- The after tax MARR is approximately equal to the pretax rate multiplied by $(1 - \text{eff inc tax rate})$