1.011 Project Evaluation
TAXES & DEPRECIATION
C.D. Martland

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.

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 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

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 asset 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.

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<th>Year</th>
<th>Before Tax Cash Flow</th>
<th>After Tax Cash Flow</th>
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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
- \( d_k = \frac{(B - S)}{N} \)
- \( d_k = \text{Deprec. year } k \)
- \( B = \text{Cost Basis} \)
- \( S = \text{salvage value} \)
- \( N = \text{life} \)
- Book value year \( k = B - k^*d_k \)

Declining Balance Depreciation
- \( d_k = B^*(1-R)^k \cdot R \)
- \( B = \text{Cost Basis} \)
- \( BV_k = B^*(1-R)^k \)
- 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)

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

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

**After tax MARR = MARR * (1 - 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 - eff inc tax rate)