American University of Armenia
IE 340 – Engineering Economics
Spring Semester, 2016

Chapter 7 – Depreciation and Income Taxes

Objective

The objective is to introduce some of the concepts and mechanics of **depreciation** and **depletion**, some historical **depreciation methods**, as well illustrate different **types of taxes**

General Accounting

✔ General Accounting:

- Preparation of financial statements for a firm. A **financial statement** (or **financial report**) is a formal record of financial activities of a business, person, or other entity

✔ Cost Accounting:

- A branch of general accounting that deals with the measurement of costs

✔ Depreciation Accounting:

- A branch of general accounting that deals with capital assets depreciation

General Accounting

✔ Balance sheet:

- Static picture of assets, liabilities and net worth at a single point in time or a summary of financial balances of a corporation

- **Assets, liabilities and ownership equity (or shareholder's equity** = initial amount of money invested into a business**)** are listed as of a specific date, such as the end of its financial year. A balance sheet is often described as a "**snapshot of a company's financial condition**"

It is comprised of the following 3 elements:

- **Assets:** Something a business owns or controls (e.g. cash, inventory, plant and machinery, etc.)
- **Liabilities:** Something a business owes to someone (e.g. creditors, bank loans, etc.)

- **Equity:** What the business owes to its owners. This represents the amount of capital that remains in the business after its assets are used to pay off its outstanding liabilities. Equity therefore represents the difference between the assets and liabilities.

Balance Sheet Sample

SAMPLE COMPANY, INC.
Balance Sheet
October 31, 2007

Assets		**Liabilities**		
Cash	$700	Accounts payable		$760
Store supplies	$2,880	**Stockholder's Equity**		
Equipment	$6,880	Contributed capitol		
		Common stock	$9,000	
		Retained earnings	$700	$9,700
		Total liabilities and		
Total assets	$10,460	stockholder's equity		$10,460

General Accounting

- **Profit and loss statement:**
  - Also called **“income statement”**
  - Income Statement reports the company's financial performance in terms of net profit or loss over a specified period.

Income Statement

- Income Statement is composed of the following two elements:
- **Income:** What the business has earned over a period (e.g. sales revenue, dividend income, etc.)
- **Expense:** The cost incurred by the business over a period (e.g. salaries and wages, depreciation, rental charges, etc.)
- **Net profit or loss** is arrived by deducting expenses from income.

Cost Accounting

- **Costs incurred to produce and sell an item or product are classified as:**
  - Direct labor
  - Direct material
  - Manufacturing cost
  - Administrative cost
  - Selling cost

Direct Costs

- **Direct material:**
  - Material whose cost is directly charged to a product
  - Measured as the sum of charges for materials necessary to produce the product
- **Direct labor:**
  - Labor cost directly attributable to a product
  - Measured by multiplying direct labor hours by the hourly wage rate

Manufacturing Costs

- **Factory Overhead**:
  - Indirect labor costs (sick leaves, vacations, bonuses as well as labor connected to inspection, cleaning…)
  - Indirect material costs (costs of materials that cannot be attributed to a particular product)
  - Fixed costs (taxes, insurance, depreciation, maintenance)
- **Factory Costs are the sum of:**
  - Direct labor costs
  - Direct material costs
  - Factory overhead

Administrative and Selling Costs

- **Administrative costs:**
  - Salaries of executive and clerical personnel, office space, traveling, auditing, necessary to direct the whole enterprise (not just its production or selling activities)

- **Selling costs**
  - Any expense involved in selling the products or services that tie in directly with sales (selling commissions, market surveys, selling bags, advertising)

Depreciation

- **As time passes, the assets lose value or depreciate**
  - **Physical loss**
    - Use related
    - Time related
  - **Functional loss**
    - Efficiency (technology) related
    - Demand (changing tastes) related
    - Capacity related

DEPRECIATION

- Decrease in value of physical properties with passage of time and use
- Accounting concept establishing annual deduction against before-tax income

  - to reflect effect of time and use on asset's value in firm's financial statement

PROPERTY IS DEPRECIABLE IF IT MUST :

- be used in business or held to produce income
- have a determinable useful life which is longer than one year
- wear out, decay, get used up, become obsolete, or lose value from natural causes
- not be inventory, stock in trade, or investment property

DEPRECIABLE PROPERTY

- **TANGIBLE** - can be seen or touched

  personal property - includes assets such as machinery, vehicles, equipment, furniture, etc...

  real property - anything erected on, growing on, or attached to land

  (Since land does not have a determinable life itself, it is not depreciable)
- **INTANGIBLE** - personal property, such as copyright, patent or franchise (out of scope of the lecture)

WHEN DEPRECIATION STARTS AND STOPS

- Depreciation starts when property is placed in service for use in business or for production of income
- Property is considered in service when ready and available for specific use, even if not actually used yet
- Depreciation stops when cost of placing it in service has been recovered or it is retired from service

DEPRECIATION CONCEPTS

The following terms are used in the classical (historical) depreciation method equations:

- N = depreciable life of the asset in years
- P = adjusted or cost basis, including allowable adjustments (cost of improvement or theft)
- D_t = annual depreciation deduction in year t ($1 \leq t \leq N$)
- TD_t = cummulative depreciation through year t
- BV_t = book value at the end of year k
- BV_N = book value at the end of the depreciable (useful) life
- SV_N = salvage value at the end of year N
- d = the ratio of depreciation in any one year to the BV at the beginning of the year

Value of an asset

- **Market value**
  - The actual value an asset can be sold for
- **Book value**
  - The depreciated value of an asset as shown on the accounting records of company. Not a useful measure of its market value
- **Salvage value**
  - Actual value of an asset at the end of its useful life. It is the expected selling price of a property when the asset can no longer be used productively by its owner

Book Value

- **Let:**
  - P = adjusted cost basis
  - BV_t = book value at the end of period *t*
  - D_t = depreciation during period t
- **Then:**
  - $BV_t = BV_{t-1} - D_t$
  - $BV_t = P - \sum_{j=1}^{t} D_t$

Capital versus expense

- Consider a copy shop, which buys:
  - Ink and paper
  - Copying (Xerox) machines
- Ink and paper are used up when they are bought (for all practical purposes):
  - Treated as an expense
  - When company buys/uses $1000 of paper,
    - It is $1000 poorer (not counting any revenue)!

Capital versus expense

- **Copying (Xerox) machines are used up only slowly over time:**
  - Treated as “capital goods”
  - When company buys a $1000 machine
    - It trades $1000 cash for $1000 in equipment
    - Not poorer at all! (assets just changed form)

- **That is why expenses can be deducted from the income fully and instantly, assets or capital need to be depreciated**

Definitions

- **Capital gains:**
  - Item selling price greater than purchase price
- **Depreciation recapture:**
  - Item selling price greater than book value
    - (Up to purchase price)
    - Taxed as ordinary income
- **Capital loss:**
  - Item sold for less than book value

Example

- If at the end of 1 year
  - I go out of business and sell my tools for $40K.
    - I bought them for $35K and Book Value=$25
  - How much capital gain (or loss) do I have?
- If at the end of 5 years
  - I go out of business and sell my tools for $5K
    - I bought them for $35K and Book Value=$10
  - How much capital gain (or loss) do I have?
- Note that book value may be 0 even when market value is positive!

Salvage value

- If a salvage value is expected,
  - Depreciation applies to P - SV
- Example:
  - If P = $35K and I expected $5K salvage value in year 5,
    - I would depreciate $30K over 5 years
      - (only $6K per year)
      - That is, ($35K-$5K)/5 instead of $35K/5
  - Ending book value would be $5K
    - No capital gain/loss unless real salvage value differs

Depreciation and taxes

- **Depreciation is treated as an expense**
  - (i.e., a *tax deduction*) in computation of income taxes
- **It is a *fictitious* expense!**
  - No cash changes hands
- Would you rather have that "expense" occur sooner or later?

Observations

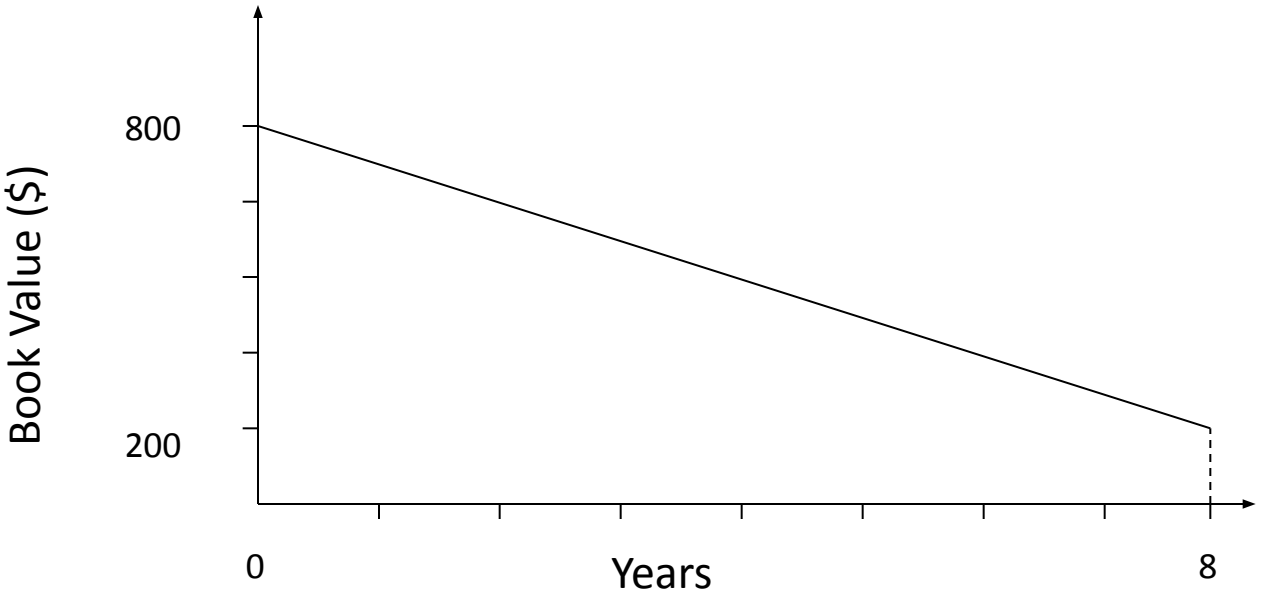
- **Depreciation methods are *conventions***
  - Not based strictly on market value!
- Different types of assets have:
  - Different recovery periods
    - (Only partially related to actual lifetime)
  - Different allowable depreciation schedules
    - (Usually codified in lookup tables)

Some Depreciation Schedules

- ✔ Straight line method (SL)
- ✔ Declining Balance method (DB)
- ✔ Double Declining Balance (DDB)
- ✔ There are more schedules used

SL Depreciation

- Constant rate of loss in the value of an asset
- Graphically: straight line between the first cost and the salvage or scrap value of the asset



SL depreciation

- Recovery period = n
- **Depreciation rate = 1/n**
  - **(Same for all years!)**
  - It depreciates (1/n)% each year
- SL Depreciation = (first cost - salvage)/n
  - (Same in all years)
- Book value in period (t)
  - = book value in period (t-1) – depreciation(t)

SL Depreciation – Cont.

$$D_{sl}(t) = (P\text{-}SV) / N$$

$D_{sl}(t)$: depreciation for period t

P: purchase value

SV: salvage value

N: useful life of the asset

$$BV_{sl}(t) = P - t\,[(P\text{-}SV) / N] = P\text{-}t * D_{sl}$$

$BV_{sl}(t)$: book-value at the end of period *t*

Example 1

- Small computers purchased by a company cost $7000 each. Past records indicate that they should have a useful life of 5 years, after which they will be disposed of, with no salvage value. Determine:
  - The depreciation charge during year 1
  - The depreciation charge during year 2
  - The book value of the computers at the end of year 3

Example 1 – Cont.

$D_{sl}(1) = D_{sl}(2) = 7000 / 5 = \$1400$

$BV(3) = 7000 – 3\ [7000 / 5] = \$2800$

Example 2

- A machine tool has:
  - First cost $35,000
  - Recovery period 20 years
    - (based on estimated life)
  - Estimated salvage value $3,500
- Depreciation = ($35,000 - $3,500)/20
  - = $1,575 (same in all years)

In table form …

t	Cash Flow	Depreciation
0	-35,000	
1	-	1,575
2	-	1,575
3	-	1,575
…	-	1,575
19	-	1,575
20	3,500	1,575

BV in year n = 1st cost – (SL Deprec)*n

Straight line depreciation

- Writes off capital investment *linearly*
- Estimated salvage value is considered:
  - Only *estimated!*
  - Actual (future) salvage value is not known when depreciation schedule is set
  - SL Depreciation gives you a constant amount each year

Declining Balance Depreciation

- Sometimes called **constant percentage method** or **Matheson formula**: assumes that the annual cost of depreciation is a fixed percentage of the BV at the beginning of the year
  - Constant proportion loss in value of an asset
  - Depreciation rate: a constant percentage

$$D_{db\ (t)} = BV_{db(t-1)} \times d$$

$D_{db\ (t)}$: depreciation amount in period *t*
$BV_{db\ (t)}$: book value at the end of period *t*
P: purchase price
d: depreciation rate

DB Depreciation

- $D(1) = P \times d$
- $D(2) = d \times (P - D(1)) = P(1-d) \times d$
- $D(3) = d \times (P - D(1) - D(2)) = P(1-d)^2 \times d$
- …
- …
- $D_{db\ (t)} = P(1-d)^{t-1} \times d$

DB Depreciation

- $D_1 = P \times d$
- $D_{db\ (t)} = P(1-d)^{t-1} \times d$
- $D_{db\ (t)} = BV_{db(t\ -\ 1)} \times d$
- $BV_{db(t)} = BV_{db(t-1)} - D_{db(t)} = BV_{db(t-1)}\ (1-d)$
- $BV_{db(t)} = P(1-d)^t$

Example 3: Example 1 revisited

- Use a depreciation rate of 40% for declining-balance method. Consider the previous example 1

$$D_{db(1)} = BV_{(0)} * (0.4) = 7000\ (0.4) = \$2800$$
$$D_{db(2)} = BV_{(1)} * (0.4) = (7000–2800)\ (0.4)$$
$$D_{db(2)} = \$1680$$
$$BV_{db(3)} = 7000\ (1\text{-}0.4)^3 = \$1512$$

Double declining balance (DDB)

- Most common form of declining balance is double declining balance or 200% declining balance (it would have been the triple and more, if the law permitted it, but the double was the maximum rate allowed):

d = 2/n, where n = recovery period

Example 4: example 2 revisited

- Consider the same machine tool
- d = 2/20 years
  - = 10% per year (or 0.1)

- Depreciation in year 1 = 0.1($35,000)
  - We use $35,000 since that is the BV in year 0
  - = $3,500 (versus $1,575 for straight line)

- Depreciation in year 2
  - = 0.1 (BV in t-1)
  - = 0.1 ($35,000 - $3,500) = $3,150, etc.

In table form

t	Cash Flow	Depreciation	BV
0	-35000	-	35000
1	-	3500	31500
2	-	3150	28350
3	-	2835	25515
4	-	2552	22964
5	-	2296	20667
...	-		
19	-	525	4728
20	-	473	4255

DDB With Conversion to SL at the Most Desirable Time

- Since DDB does not use a value for Salvage, we have three possible scenarios at time of disposal:
  - **Over depreciation:** Book Value < Salvage Value. Tax savings realized early. Small gain upon sale of the asset and taxes on the gain.
  - **Exact depreciation:** Book value = Salvage value. There are no tax consequences upon sale of the asset.
  - **Under depreciation:** Book Value > Salvage Value. Did not deduct as much as you could have and lost tax savings.
    - To allow companies take advantage of all the depreciation charges they are entitled to, they can switch from **DDB to straight line at the most favorable time.**

Example: DB Switching to SL

Depreciation Base	**$10,000**
Salvage Value	**0**
Depreciation	**200% DB**
Depreciable life	**5 years**

- SL Dep. Rate = 1/5
- a (DDB rate) = (200%) (SL rate)
  = 2/5

Case 1: S = 0

(a) Without switching

n	Depreciation	Book Value
1	10,000(0.4) = 4,000	$6,000
2	6,000(0.4) = 2,400	3,600
3	3,600(0.4) = 1,440	2,160
4	2,160(0.4) = 864	1,296
5	1,296(0.4) = 518	778

(b) With switching to SL

n	Depreciation	Book Value
1	10000/5= 2 000< 4,000	$6,000
2	6,000/4 = 1,500 < 2,400	3,600
3	3,600/3 = 1,200 < 1,440	2,160
4	2,160/2 = 1,080 > 864	1,080
5	1,080/1 = 1,080 > 518	0

Note: Without switching, we have not depreciated the entire cost of the asset and thus have not taken full advantage of depreciation's tax deferring benefits.

Case 2: S = $2,000

End of Year	Depreciation	Book Value
1	0.4($10,000) = $4,000	$10,000 - $4,000 = $6,000
2	0.4(6,000) = 2,400	6,000 – 2,400 = 3,600
3	0.4(3,600) = 1,440	3,600 –1,440 = 2,160
4	0.4(2,160) = 864 > 160	2,160 – 160 = 2,000
5	0	2,000 – 0 = 2,000

Note: Tax law does not permit us to depreciate assets below their salvage values.

Sum-of-Years' Digits (SYD) Method

- **Principle**

Depreciation concept similar to DB but with decreasing depreciation rate.

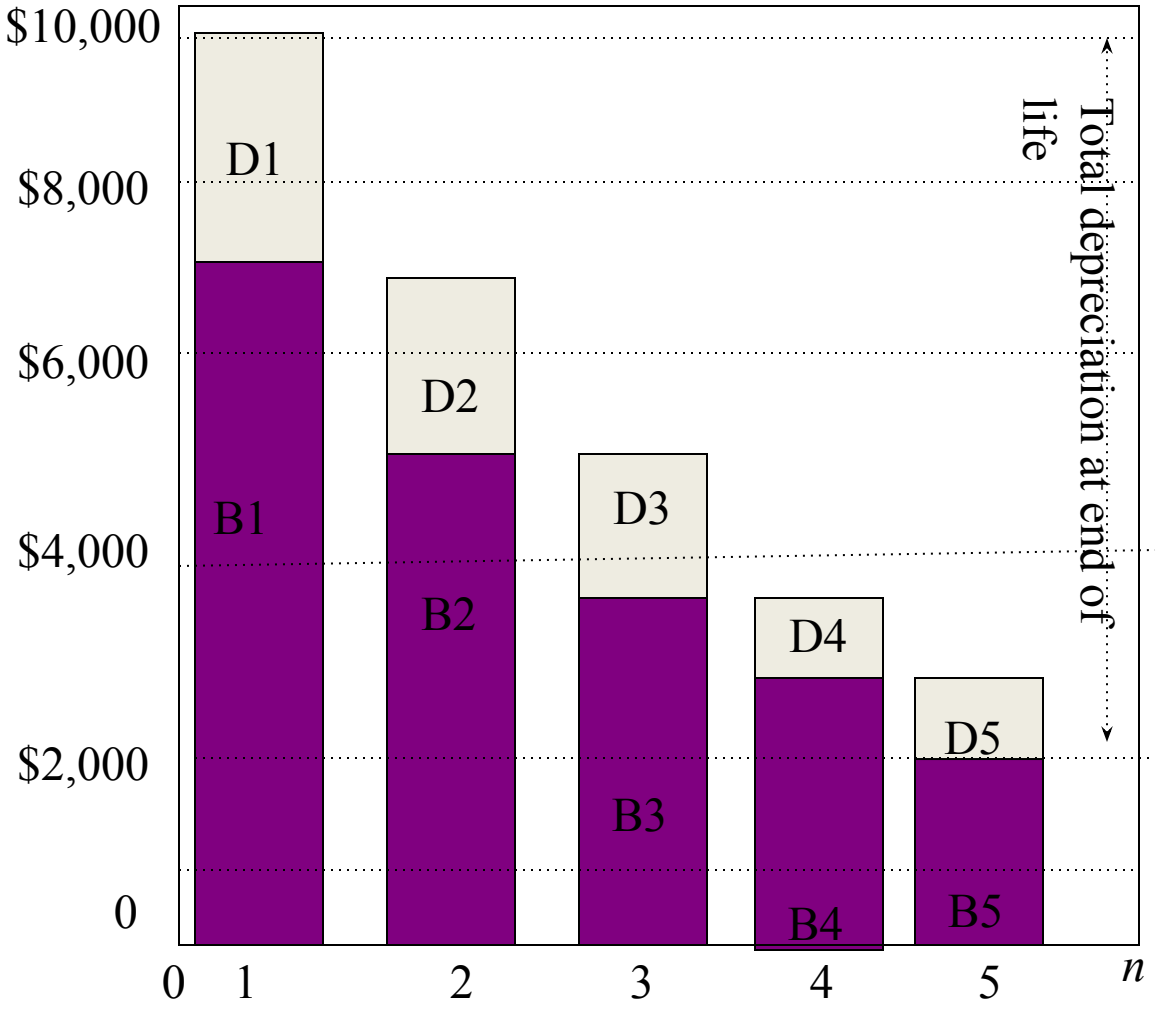
Charges a larger fraction of the cost as an expense of the early years than of the later years.

- **Formula**
  - **Annual Depreciation**
  - **Book Value**

$$D_t = (P - S)(N - t + 1) / SOYD$$

$$B_t = P - \sum_{j=1}^{t} D_j \qquad \text{where } SYD = N(N+1)/2$$

Example 10.7 – SYD method



Annual Depreciation

Book Value

P = \$10,000
N = 5 years
S = \$2,000
SOYD = 15

n	D_n	B_n
1	(5/15)(8,000)=\$2,667	\$7,333
2	(4/15)(8,000)=\$2,133	5,200
3	(3/15)(8,000)=\$1,600	3,600
4	(2/15)(8,000)=\$1,067	2,533
5	(1/15)(8,000)=\$533	2,000

Units-of-Production Method

- Principle

  Service units will be consumed in a non time-phased fashion (decrease in value of property is a function of use and not function of time)

- Formula

$$D_{per\ unit} = \frac{(P - SV)}{\text{Estimated lifetime production units}}$$

See Example 7-4

See Example 7-4

A piece of equipment used in a business has a basis of $50.000 and is expected to have a $10.000 SV when replaced after 30.000 hours of use. Find its depreciation rate per hour of use, and find its BV after 10.000 hours of operation.

Solution

Depreciation per unit of production = ($50.000-$10000)/30.000 hours = $1.33 per hour

After 10.000 hours BV = $50.000 - $1.33*(10.000 hours) = 36.700

Depletion

Two methods of natural resource depletion

- **Cost or factor depletion**
- **Percentage depletion**

Cost Depletion

Depletion is computed on a per unit basis

Per unit amount is determined by dividing the basis of the resource (FC) by the estimated recoverable units of resource

Number of units sold in year × per unit depletion = depletion for year

Total depletion can not exceed total cost of the property

Cost Depletion: An Example

Suppose a reservoir contains an estimated **1,000,000** barrels of oil, and requires an initial investment of **$7,000,000** to develop. Asume that **50,000** barrels of oil are produced annually

Unit Depletion Rate = 7,000,000/1,000,000 = $7 per barrel

Depletion Charge = 50,000 (7) = $350,000

Percentage Depletion

- **Percentage depletion**
  - Depletion is computed by using the statutory percentage rate for the type of resource
  - Rate is applied to the gross income from the property

- **Percentage depletion**
  - Percentage depletion cannot exceed 50% of the taxable income (before depletion) from the property
  - Percentage depletion reduces basis in property
  - However, total percentage depletion may exceed the total cost of the property

Percentage Depletion Allowances for Mineral Properties

Deposits	Percentage
Oil and gas wells (only for certain domestic and gas production)	22
Sulfur and uranium, and, if from deposits in the United States, asbestos, lead, zinc, nickel, mica, and certain other ores and minerals	15
Gold, silver, copper, iron ore, and oil shale, if from deposits in the United States	15
Coal, lignite, and sodium chloride	10
Clay and shale to be used in making sewer pipe or bricks	7.5
Clay (used for roofing tile), gravel, sand, and stone	5
Most other minerals; includes carbon dioxide produced from a well and metallic ores.	14

Percentage Depletion: An Example

Assume in the previous (oil) example that the price for oil is $23 per barrel and the expenses to produce oil (apart from the initial cost) are $380,000

Gross Depletion Income = 50,000*23 = $1,150,000

Depletion Rate = 22%

Percentage Depletion Charge = $253,000

Now check if that amount exceeds the maximum depletion charge allowed by law

Percentage Depletion: An Example

Gross Depletion Income =	$1,150,000
Less expenses =	- $380,000
	$770,000
Deduction Limitation	*50%*
Maximum Depletion Charge	*$385,000*

$253,000 < $385,000, so full charge is allowable

Agenda for today

- We will learn how to determine:
  - Before-tax cash flows
  - Taxable income
  - Income taxes
  - After-tax cash flow
- We will see the effects of depreciation schedule on *after*-tax IRR
- Examples

Agenda for today

- Review terms and definitions
  - Rate of return (ROR)
  - Tax deduction
  - Tax credit
  - Capital gain/loss
  - Charity deductions
  - Bonds
- Examples

Why do we calculate depreciation?

- Since depreciation is an “expense” we can use that expense to reduce our taxable income, and therefore reduce the amount of taxes we pay.

- We have to know how much our equipment has depreciated to determine the deductions to be made.

Definitions

- **Net versus gross income:**
  - Gross income = revenue or receipts
  - Net income = revenue minus expenses
- **Corporate tax is on net income (profit)**
  - Individual tax is on gross income
- **Income taxes are an additional expense**

How to calculate After-Tax Cash Flow?

- Determine before-tax cash flows (BTCF)
- Determine taxable income (TI):
  - Revenues – (depreciation & other expenses)
- Compute income taxes (Tax):
  - (Taxable income) * (tax rate)
- Determine after-tax cash flow (ATCF):
  - Before-tax cash flow - income taxes

Taxable Income and Income Taxes (An Example)

Item	Amount
Gross income (revenue)	$50,000
Expenses	
Cost of goods sold	20,000
Depreciation	4,000
Operating expenses	6,000
Taxable income	20,000
Taxes (40%)	8,000
After-tax net income	$12,000

General table …

Assume first cost=120, revenue=32, SL dep, SV=0, tax=40%

A	B	C	D	E	F
Year	*Cash flow*	*Deprec.*	*Tax. Inc.*	*Taxes*	*After-tax cash flow*
		(120/8)	(B-C)	(D*40%)	(B-E)
0	-120.0				-120.0
1	32.0	15.0	17.0	6.8	25.2
2	32.0	15.0	17.0	6.8	25.2
3	32.0	15.0	17.0	6.8	25.2
4	32.0	15.0	17.0	6.8	25.2
5	32.0	15.0	17.0	6.8	25.2
6	32.0	15.0	17.0	6.8	25.2
7	32.0	15.0	17.0	6.8	25.2
8	32.0	15.0	17.0	6.8	25.2
9	32.0	0.0	32.0	12.8	19.2
10	32.0	0.0	32.0	12.8	19.2

Observations

- Land is *capital*
  - Land purchase is not an expense!
  - Land sale proceeds are not revenue!
    - Just convert cash assets into land, vice versa
    - Capital gains are revenue.
- Income taxes are an additional expense
  - *But the timing of this expense is critical!*
  - Results can vary a great deal depending on the timing of depreciation

Depreciation example (SL)

- Investment with depreciation
- Buy equipment for $110K for 10 years:
  - No salvage value
  - Straight-line depreciation
  - Savings of $32K per year
  - Costs of $5.7K per year
    - Net savings of $26.3K per year
  - Tax is 40%

Depreciation example (SL)

Year	Cash flow	Deprec.	Tax. Inc.	Taxes	After-tax cash flow
0	-$110K				-$110K
1-10	+$26.3K	$11K	+$15.3K	$6.12K	+$20.18K

- SL Deprec. = (110-0)/10 = 11
- Taxable income = income - depreciation
  - Depreciation is treated as an expense!
- Rate of return (IRR) =
  - 20.1% before taxes
  - 12.9% after taxes

Longer depreciation (25 years)

0	-$110K				-$110K
1-10	+$26.3K	$4.4K	+$21.9K	$8.76K	+$17.54K
11-25	$0K	$4.4K	-$4.4K	$0K	$0K

- What would you expect:
  - Will IRR go up or down?
  - I am extending the depreciation and paying more taxes sooner.

Comparison

- 10 year (SL) depreciation schedule:
  - Rate of return
    - 20.1% before taxes,
    - 12.9% after taxes
- 25 year (SL) depreciation schedule:
  - After-tax rate of return = 9.5%
    - Why is it *less?*
  - What happens to after-tax rate of return?

Accelerated depreciation

- 7 year depreciation lifetime:
  - Double declining balance for 4 years
  - Followed by straight line for 3 years
- What would you expect:
  - Will IRR go up or down?

Accelerated depreciation

Year	Cash flow	Deprec.	Tax. Inc.	Taxes	After-tax cash flow
0	-110				-110
1	26.3	31.43	-5.13	-2.05	28.35
2	26.3	22.45	3.85	1.54	24.76
3	26.3	16.03	10.27	4.11	22.19
4	26.3	11.45	14.85	5.94	20.36
5	26.3	9.54	16.76	6.70	19.60
6	26.3	9.54	16.76	6.70	19.60
7	26.3	9.54	16.76	6.70	19.60
8	26.3		26.3	10.52	15.78
9	26.3		26.3	10.52	15.78
10	26.3		26.3	10.52	15.78
Sum		110			

Accelerated depreciation

- How to figure out after-tax IRR?
  - Use column for *after-tax cash flow (just that column!)*
  - Calculate IRR as usual
  - After-tax IRR = 14.7%
- Tax benefit of depreciation accelerated,
  - So after-tax IRR went up (>12.9%)

Net Income vs. Cash Flow

Net income is an accounting means of measuring a firm's profitability based on the matching concept. Costs become expenses as they are matched against revenue. The *actual timing of cash* inflows and outflows are ignored.

Cash flow: Given the *time value of money*, it is better to receive cash now than later, because cash can be invested to earn more money. That is why cash flows are relevant data to use in project evaluation.

Why Do We Use Cash Flow in Project Evaluation?

Example: Both companies (A & B) have the same amount of net income and cash sum over 2 years, but Company A returns $1 million cash yearly, while Company B returns $2 million at the end of 2nd year. Company A can invest $1 million in year 1, while Company B has nothing to invest during the same period.

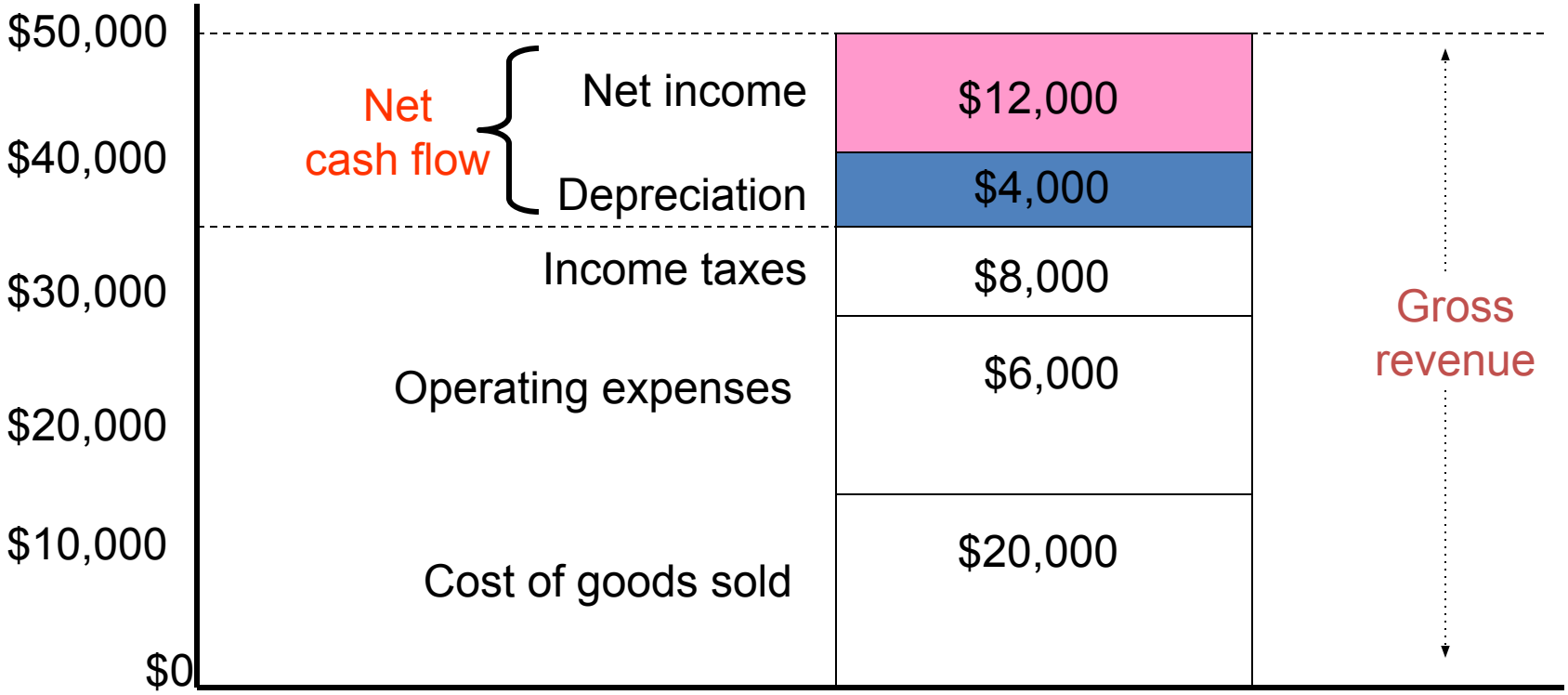
		Company A	Company B
Year 1	Net income	$1,000,000	$1,000,000
	Cash flow	1,000,000	0
Year 2	Net income	1,000,000	1,000,000
	Cash flow	1,000,000	2,000,000

Example: Cash Flow vs. Net Income

Item	Income	Cash Flow
Gross income (revenue)	$50,000	$50,000
Expenses		
Cost of goods sold	20,000	-20,000
Depreciation	4,000	
Operating expenses	6,000	-6,000
Taxable income	20,000	
Taxes (40%)	8,000	-8,000
Net income after-tax	$12,000	
Net cash flow		$16,000

Net income versus net cash flow

Net cash flows = Net income + non-cash expense (depreciation)



Definitions

- Tax *deduction*:
  - Expense deducted from taxable *income*
    - Saving = (deduction) x (tax rate)
    - Savings are not equal to deductions, just a %
- Tax *credit*:
  - Expense deducted from *taxes*
    - Saving = 100% of tax credit
- Tax *exemption*:
  - *Income* that is not taxable

Definitions

- **Book value:**
  - **Purchase price**
    - **(for land, stocks, other non-depreciable assets)**
  - **Depreciated value**
    - **(for physical assets, patents, other depreciable assets)**

Definitions

- **Capital gains:**
  - Item selling price greater than purchase price
- **Depreciation recapture:**
  - Item selling price greater than book value
    - (Up to purchase price)
    - Taxed as ordinary income
- **Capital loss:**
  - Item sold for less than book value

Capital gain/loss

- Generally attributed to year of sale
- Long-term capital gains (> 1 year)
  - Can be taxed less than ordinary income
- Capital loss not deducted from income:
  - Only from capital gains (for companies)
    - *Losses can be carried over to future years!*

Capital gain/loss

- Carrying backward or forward:
  - Some businesses are very volatile
    - E.g., oil prospecting!
  - Some years may have net losses
  - Can use past losses to offset future gains
    - Can carry forward for up to 5 years

Example

- Investment with depreciation
- Buy equipment for $110K for 10 years:
  - No salvage value
  - Straight-line depreciation

Example

- Sell for $30K in year 8:
  - Book value = $22K
  - Depreciation recapture = $8K
- Sell for $20K in year 8:
  - Capital loss = $2K
  - *Cannot* deduct from ordinary income
    - Deduct from *gain* (now or in another year)

Non-depreciable example

- Investment with *no* depreciation
- Buy *land* for $110K
- Sell for $130K:
  - Capital gain = $20K
- Sell for $100K:
  - Capital loss = $10K (offset against gains)
- Note: with land there can't be Depreciation Recapture. Why?

Capital gain/loss

- Taxable income =
  - Gross income (i.e., revenues or receipts)
    - Minus operating expenses
    - Minus depreciation
    - *Plus* depreciation recapture
    - *Plus* capital gains
    - Minus capital losses
      - (up to size of capital gains, but no greater)

Personal income tax

- Same general issues as corporate tax:
  - Tax exempt income
    - (E.g., government bonds)
  - Tax deductions
    - (E.g., charitable donations, interest payments)

Tax-exempt example

- Purchase $5K bond (20 years)
  - From phone company at 11%:
    - $550/year, paid as $275 every 6 months
  - Municipal bond from …. at 7.5%:
    - $375/year, paid as $187.50 every 6 months
- Assume a tax rate:
    - tax rate = 33.8%

Tax-exempt example

- Phone company bond at 11%:
  - $550/year, paid as $275 every 6 months
  - Tax = ($550) x (33.8%) = $185.9
  - *After-tax* income
    - $550 - $185.9 = $364.10
- Municipal bond at 7.5% (tax exempt):
  - $375/year (after-tax income greater!)

Observation

- A government bond (tax-exempt) at 7.5% may give higher income than a private 11% bond!
- Desirability will vary with income:
  - Higher income gives higher tax rate
  - Tax exemption becomes more desirable

Charitable deduction example

- Assume the following tax rate:
  - tax rate = 38.4%
- Charitable gift of $1000:
  - Tax deduction = ($1000) x (38.4%) = $384
  - *True* cost of gift = $1000 - $384 = $616
    - Government is encouraging charity!

Graduated income tax

- Constant tax rate:
  - "Flat tax"
- If tax rate is not constant:
  - "Graduated" income tax

Graduated income tax

- Example:
  - 15% if taxable income < $50K
  - $7.5K + 25% of amount above $50K
    - If taxable income between $50K and $75K
  - $13.75K + 34% of excess over $75K
    - If taxable income > $75K

Example - Corporate Income Taxes

Facts:

Capital expenditure	$100,000	
(allowed depreciation)	$58,000	
Gross Sales revenue		$1,250,000
Expenses:		
Cost of goods sold	$840,000	
Depreciation	$58,000	
Leasing warehouse	$20,000	

Question: Taxable income?

Example - Corporate Income Taxes

Taxable income:		
Gross income	$1,250,000	
- Expenses:		
(cost of goods sold)	$840,000	
(depreciation)	$58,000	
(leasing expense)	$20,000	
Taxable income	**$332,000**	
Income taxes:		
First $50,000 @ 15%		$7,500
$25,000 @ 25%		$6,250
$25,000 @ 34%		$8,500
$232,000 @ 39%		$90,480
Total taxes		**$112,730**

Example - Corporate Income Taxes

- Average tax rate:

  Total taxes = $112,730

  Taxable income = $332,000

$$\text{Average tax rate} = \frac{\$112,730}{\$332,000}$$

$$= 33.95\%$$

- Marginal tax rate:

Tax rate that is applied to the last dollar earned = 39%

U.S. Corporate Tax Rate (2001)

Taxable income	Tax rate	Tax computation
0-$50,000	15%	$0 + 0.15(Δ)
$50,001-$75,000	25%	$7,500 + 0.25 (Δ)
$75,001-$100,000	34%	$13,750 + 0.34(Δ)
$100,001-$335,000	39%	$22,250 + 0.39 (Δ)
$335,001-$10,000,000	34%	$113,900 + 0.34 (Δ)
$10,000,001-$15,000,000	35%	$3,400,000 + 0.35 (Δ)
$15,000,001-$18,333,333	38%	$5,150,000 + 0.38 (Δ)
$18,333,334 and Up	35%	$6,416,666 + 0.35 (Δ)

(Δ) denotes the taxable income in excess of the lower bound of each tax bracket

Marginal and Effective (Average) Tax Rate for a Taxable Income of $16,000,000

$$\text{Average tax rate} = \frac{\$5{,}530{,}000}{\$16{,}000{,}000} = 34.56\%$$

Taxable income	Marginal Tax Rate	Amount of Taxes	Cumulative Taxes
First $50,000	**15%**	**$7,500**	$7,500
Next $25,000	**25%**	**6,250**	13,750
Next $25,000	**34%**	**8,500**	22,250
Next $235,000	**39%**	**91,650**	113,900
Next $9,665,000	**34%**	**3,286,100**	3,400,000
Next $5,000,000	**35%**	**1,750,000**	5,150,000
Remaining $1,000,000	**38%**	**380,000**	$5,530,000

How to Determine Income Tax Rate to be Used in Economic Analysis?

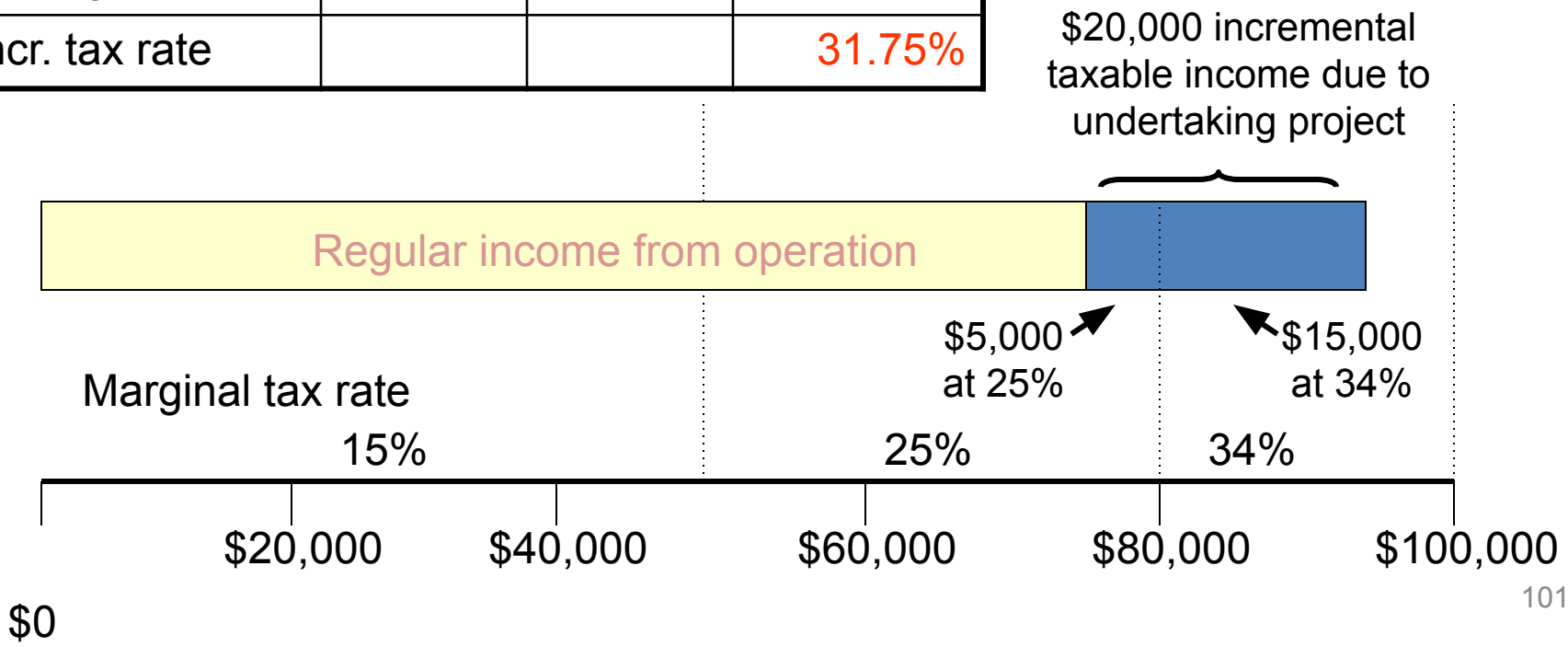
	Regular Business	Project
Revenues	$200,000	$40,000
Expenses	$130,000	$20,000
Taxable Income	$70,000	$20,000
Income Taxes	$12,500	?

Incremental Income Tax Rate

	Before Undertaking Project	After Undertaking Project	The Effect of Project
Gross revenue	$200,000	$240,000	$40,000
Expenses	130,000	150,000	20,000
Taxable income	$70,000	$90,000	$20,000
Income taxes	$12,500	$18,850	$6,350
Average tax rate	17.86%	20.94%	**31.75%**

0.25($5,000/$20,000) + 0.34($15,000/$20,000) = 31.75%

	Before	After	Increment
Taxable income	$70,000	$90,000	$20,000
Income taxes	12,500	18,850	6,350
Average tax rate	17.86%	20.94%	
Incr. tax rate			31.75%



Accelerated depreciation

- With *accelerated depreciation*
  - Depreciation expenses happen sooner than with straight line depreciation (is this better or worse?)
- Income tax liability is reduced early on
  - Greater in future years
    - This is beneficial due to *time value of money!*