Faculty of Engineering
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Depreciation Methods

Introduction

- Depreciation is the reduction in value of an asset because of age, wear, and obsolescence.
- Assets: equipment, computers, vehicles, buildings, and machinery.
- The method used to depreciate an asset is a way to account for the decreasing value of the asset to the owner and to represent the diminishing value (amount) of the capital funds invested in it.

Introduction

- **Book depreciation** and **tax depreciation** are terms used to describe the purpose for reducing asset value.

- Depreciation may be performed for two reasons:

1. Use by a corporation or business for internal financial accounting. This is book depreciation.
2. Use in tax calculations per government regulations. This is tax depreciation.

Depreciation Terminology

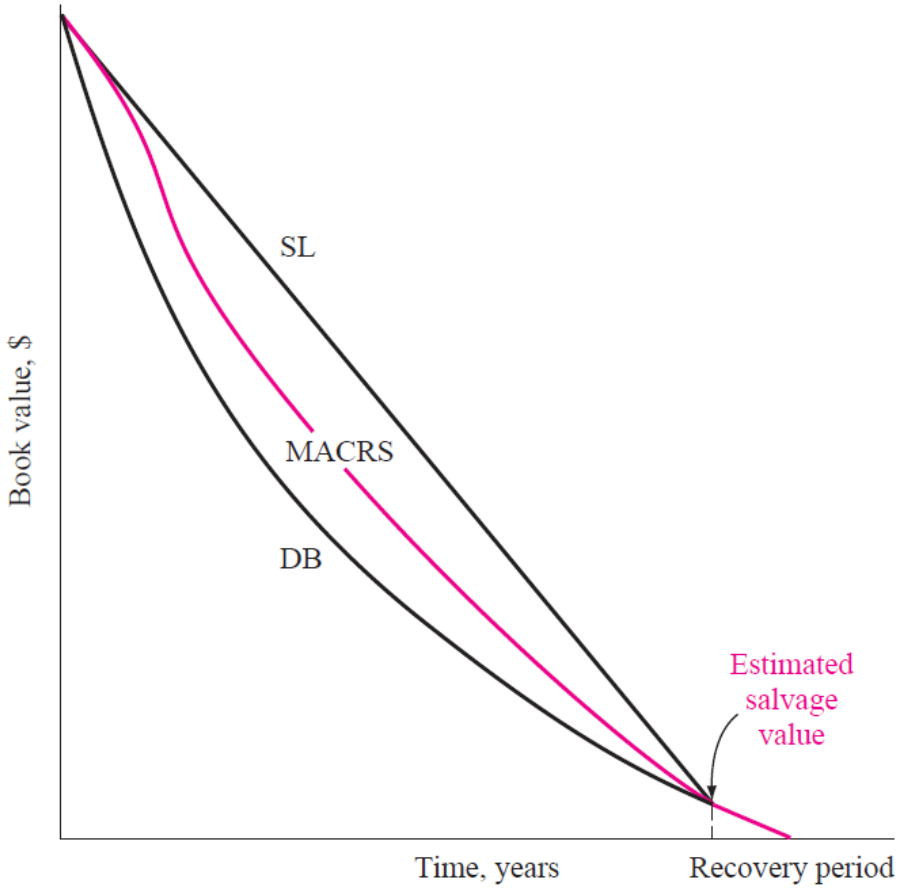
- **First cost** (**basis**) is the delivered and installed cost of the asset including purchase price, installation fees, and any other depreciable direct costs.
- **Book value** represents the remaining, undepreciated investment after the total amount of depreciation charges to date have been removed. The book value is determined at the end of each year.
- **Recovery period** is the depreciable life *n* in years. Often there are different *n* values for book and tax depreciation.
- **Market value** is the estimated amount realizable if the asset were sold on the open market.

Depreciation Terminology

- **Depreciation rate** or **recovery rate** d_t is the fraction of the first cost removed by depreciation each year.
- **Personal property**, one of the two types of property for which depreciation is allowed, is the income-producing, tangible possessions of a corporation.
  - Vehicles, manufacturing equipment, computer equipment, chemical processing equipment, and construction assets.
- **Real property** includes real estate and all improvements - office buildings, factories, warehouses, apartments, and other structures.

Depreciation Models

- The straight line (SL) model.
- Accelerated models, such as the declining balance (DB) model.
- Accelerated Cost Recovery System (ACRS).
  - MACRS (Modified ACRS).



Straight Line (SL) Depreciation

- The straight line (SL) model is used, historically and internationally, considered the standard against which any depreciation method is compared.
- It derives its name from the fact that the book value decreases linearly with time.
- For *book depreciation* purposes, it offers an excellent representation of book value for any asset that is used regularly over a number of years.

Straight Line (SL) Depreciation

- The annual SL depreciation is determined by multiplying the first cost minus the salvage value by the depreciation rate.

$$D_t = (B - S)d$$
$$= \frac{B - S}{n}$$

where D_t = depreciation charge for year t ($t = 1, 2, \ldots, n$)
B = first cost
S = estimated salvage value
n = recovery period
d = depreciation rate = $1/n$

Straight Line (SL) Depreciation

- Since the asset is depreciated by the same amount each year, the book value after t years of service (BV_t), is the first cost B minus the annual depreciation times t.

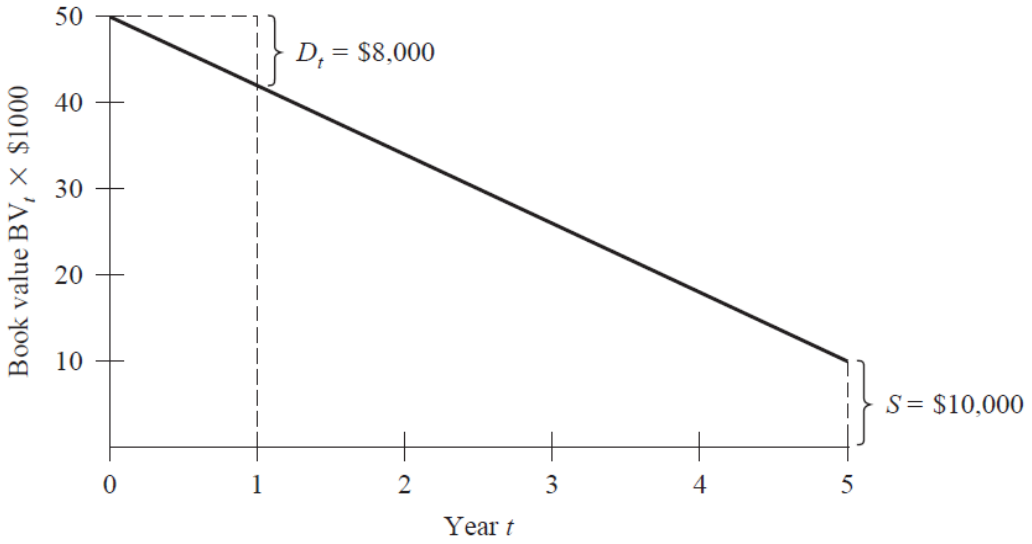
$$BV_t = B - tD_t$$

Example 1

- If an asset has a first cost of $50,000 with a $10,000 estimated salvage value after 5 years, calculate the annual SL depreciation and plot the yearly book value.
- **Solution**
- The depreciation each year for 5 years is:

$$D_t = \frac{B - S}{n} = \frac{50{,}000 - 10{,}000}{5} = \$8000$$

$$\text{BV}_5 = 50{,}000 - 5(8000) = \$10{,}000 = S$$



Declining Balance (DB) Depreciation

- Declining balance is also known as the fixed percentage or uniform percentage method.
- The declining balance model, decrease the book value to the salvage value more rapidly than the straight line method.
- The depreciation for year *t* is the fixed rate *d* times the book value at the end of the previous year.

$$D_t = (d)\mathrm{BV}_{t-1}$$

- Book value in year *t* is determined by:

$$\mathrm{BV}_t = B(1-d)^t$$

Declining Balance (DB) Depreciation

- The maximum annual depreciation rate for the DB method is twice the straight line rate.

$$d_{\max} = 2/n$$

- This is called ***double declining balance*** (***DDB***).
- If n = 5 years, the DDB rate is 0.4; so 40% of the book value is removed annually.
- Another commonly used percentage is 150% of the SL rate, where $d = 1.5/n$.

Example 2

- Albertus Natural Stone Quarry purchased a computer-controlled saw for $80,000. The unit has an anticipated life of 5 years and a salvage value of $10,000. Compare the schedules for annual depreciation and book value using two methods: DB at 150% of the straight line rate and at the DDB rate.

- **Solution**

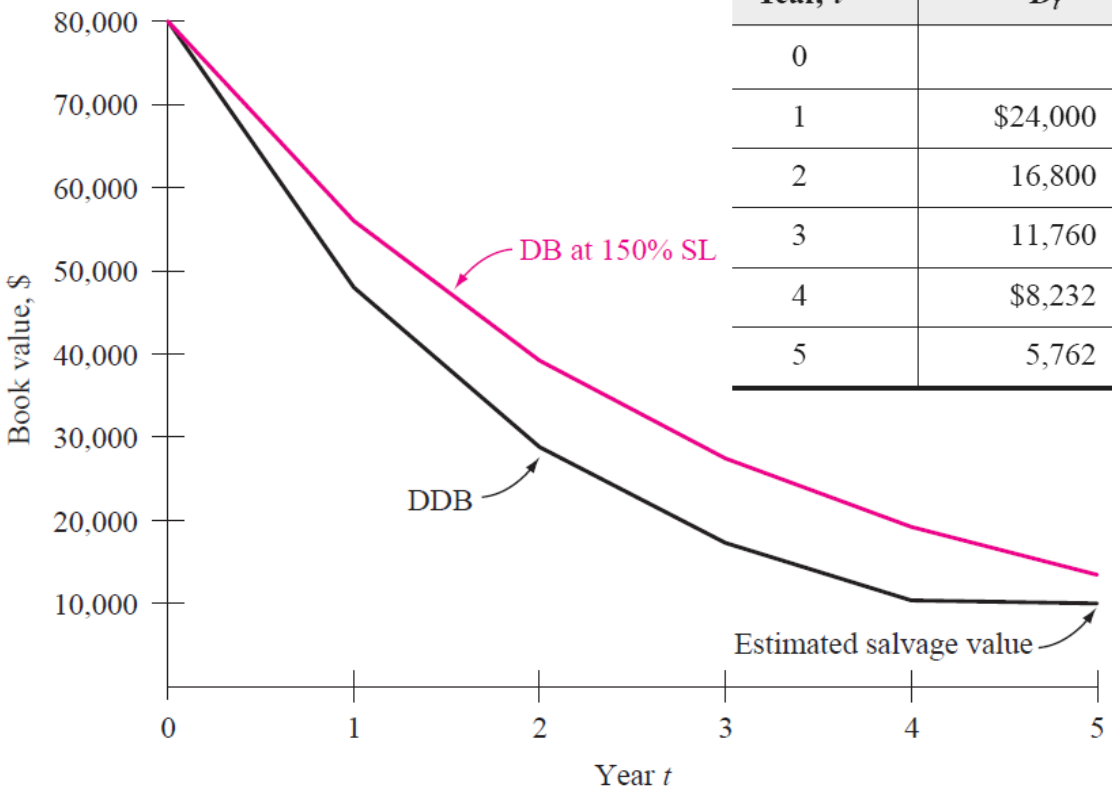
- **150% DB:** The depreciation rate is $d = 1.5/5 = 0.30$

$$D_2 = 0.30(56{,}000) = \$16{,}800$$
$$BV_2 = 80{,}000(0.70)^2 = \$39{,}200$$

- **DDB:** The rate is $d_{max} = 2/5 = 0.40$

$$D_3 = 0.40(28{,}800) = \$11{,}520$$
$$BV_3 = 80{,}000(0.60)^3 = \$17{,}280$$

Example 2



	Declining Balance, $d = 0.30$		Double Declining Balance, $d = 0.40$	
Year, t	D_t	BV_t	D_t	BV_t
0		$80,000		$80,000
1	$24,000	56,000	$32,000	48,000
2	16,800	39,200	19,200	28,800
3	11,760	27,440	11,520	17,280
4	$8,232	19,208	6,912	10,368
5	5,762	13,446	368	10,000

Modified Accelerated Cost Recovery System (MACRS)

- In the 1980s, the U.S. introduced MACRS as the required *tax depreciation* method for all depreciable assets.
- MACRS rates take advantage of the accelerated DB and DDB methods. However corporations are still free to apply any of the classical methods for book depreciation.
- MACRS determines annual depreciation amounts using the relation:

$$D_t = d_t B$$

- Where the depreciation rate is tabulated in next table.

MACRS Depreciation Rates

Year	Depreciation Rate (%)					
	$n = 3$	$n = 5$	$n = 7$	$n = 10$	$n = 15$	$n = 20$
1	33.33	20.00	14.29	10.00	5.00	3.75
2	44.45	32.00	24.49	18.00	9.50	7.22
3	14.81	19.20	17.49	14.40	8.55	6.68
4	7.41	11.52	12.49	11.52	7.70	6.18
5		11.52	8.93	9.22	6.93	5.71
6		5.76	8.92	7.37	6.23	5.29
7			8.93	6.55	5.90	4.89
8			4.46	6.55	5.90	4.52
9				6.56	5.91	4.46
10				6.55	5.90	4.46
11				3.28	5.91	4.46
12					5.90	4.46
13					5.91	4.46
14					5.90	4.46
15					5.91	4.46
16					2.95	4.46
17–20						4.46
21						2.23

Modified Accelerated Cost Recovery System (MACRS)

- The book value in year *t* is determined by subtracting the annual depreciation from the previous year's book value:

$$\mathrm{BV}_t = \mathrm{BV}_{t-1} - D_t$$

- The MACRS assumes that *S* = 0 (the first cost is always completely depreciated), even though there may be an estimated positive salvage.

Depletion Methods

- Depletion is another method to write off investment that is applicable only to ***natural resources***.
- When the resources are removed, they cannot be replaced or repurchased in the same manner as can a machine, or structure.
- Depletion is applicable to mines, wells, quarries, geothermal and forests.
- There are two methods of depletion- *percentage* and *cost depletion*.
- ***Percentage depletion*** is a special consideration given for natural resources, while ***cost depletion*** (also called factor depletion), is based on the level of activity or usage.

Percentage Depletion

$$\text{Percentage depletion amount} = \text{percentage} \times \text{gross income from property}$$

Deposit	Percentage
Sulfur, uranium, lead, nickel, zinc, and some other ores and minerals	22%
Gold, silver, copper, iron ore, and some oil shale	15
Oil and natural gas wells (varies)	15–22
Coal, lignite, sodium chloride	10
Gravel, sand, some stones	5
Most other minerals, metallic ores	14

Example 3

- A gold mine was purchased for $10 million. It has an anticipated gross income of $8 million per year for years 1 to 5 and $5 million per year after year 5. Compute the annual depletion amount.

- **Solution**

- **A 15% depletion applies for gold.**
  Years 1 to 5: 0.15(8.0 million) = $1.2 million
  Years thereafter: 0.15(5.0 million) = $750,000

- A total of $6 million is written off in 5 years, and the remaining $4 million is written off at $750,000 per year.