



رویکردی جامع برای ارزیابی اقتصادی در پروژه همراه با آموزش مدلسازی در اکسل (Excel)

بخش هفتم:

ارزیابی اقتصادی: ارزیابی اقتصادی با در نظر گرفتن تورم

ارائه دهندگان:

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کامبیز کردانی

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What we will learn?

- ☐ Inflation and purchasing power
- ☐ Impact of inflation
- ☐ Causes of inflation
- ☐ Measure to bring inflation down
- ☐ Consequences of inflation
- ☐ Measure of inflation
- ☐ Treating inflation in economic analysis
- ☐ Example 1
- ☐ Example 2



Inflation and purchasing power

Inflation is an increase in the amount of money necessary to obtain the **same amount** of goods or services before the inflated price was present.

Purchasing power, or **buying power**, measures the value of a currency in terms of the quantity and quality of goods or services that one unit of money will purchase. Inflation decreases the purchasing ability of money in that **less** goods or services **can be purchased** for the same one unit of money.

Impact of inflation

- ❑ Inflation **occurs** because the **value of the currency** has **changed**.
 - ❖ The **value of money** has **decreased**, and as a result, it takes **more money** for the **same amount** of goods or services.
 - ✓ This is a **sign of inflation**
- ❑ In **economic analysis** when the **rate of inflation** is **low**, we can **ignore it**, but when it is **not low** we have to consider it in the **cash flow**,
since the **MARR does not include inflation rate**.

Impact of inflation

❑ Factors such as:

1. Cost of energy
2. Interest rates
3. Availability and cost of skilled people
4. Scarcity of materials
5. Political stability
6. Other

have short-term and long-term **impacts** on the **inflation rate**

Causes of inflation

1. Excessive money poured into economy (تورم ناشی از افزایش نقدینگی)
2. Demand-pull inflation (تورم ناشی از فشار تقاضا)
3. Cost push inflation (تورم ناشی از فشار هزینه)
4. Built-in inflation (تورم ناشی از افزایش هزینه دستمزد به علت افزایش هزینه زندگی)
5. International forces (تورم ناشی از فشارهای بین المللی)
6. Unresponsive prices (تورم ناشی از قیمت گذاری بی منطق و بدون کنترل)
7. Inflation psychology (تورم روانی)

Causes of inflation – Excessive money poured into economy

❑ An increase in money supply in an economy may lead to **inflation** if not resulted in gross domestic product (GDP) **increase** because:

❖ More money **available** to individuals to be spent.

✓ This **increases** the **demand**, and leads to **price rises**.

*If the **money supply** increases at the **same rate** as **real output**, then prices will **stay the same**!*

وقتی که عرضه پول در اقتصاد زیاد باشد (البته عرضه ای که به رشد اقتصادی منجر نشود) این عرضه زیاد پول میتواند یک نوع سیاست پولی باشد که البته اگر به رشد اقتصادی منجر نشود، منجر به ایجاد تورم میشود، پس تورم برابر است با کسر درصد رشد نقدینگی از درصد رشد اقتصادی و اگر با تزریق زیاد پول تنها مقدار کمی رشد اقتصادی ایجاد شود، این مسئله بسیار خطرناک است.

Causes of inflation – Excessive money poured into economy

❑ Money supply can be **increased** by:

1. Supplying the money to the **individuals**
2. Devaluing (**reducing the value of**) the currency

In all such cases of demand **increase**, the money **loses** its purchasing power

Causes of inflation – Excessive money poured into economy

❑ This theory establishes the relation between **inflation** and **money supply** of an economy.

❖ Inflation is **relative**, but **not absolute**.

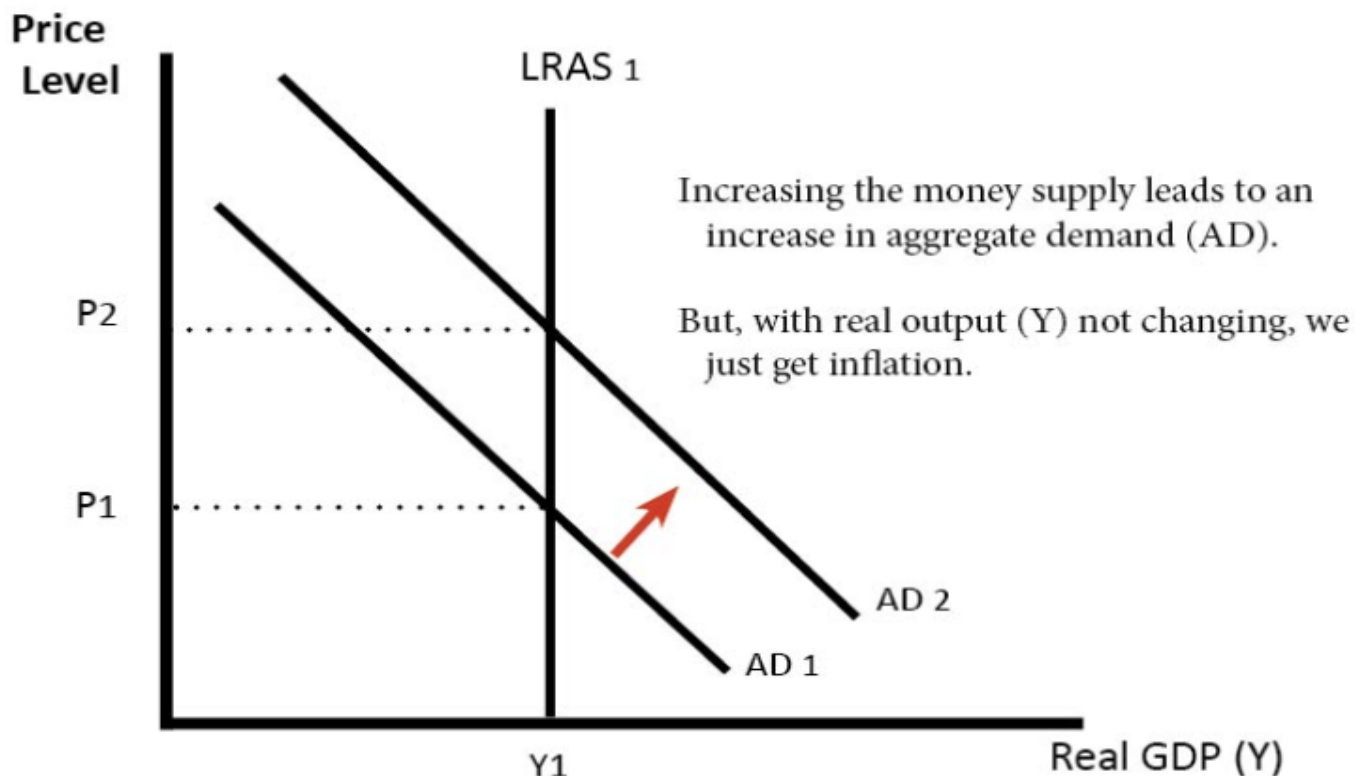
❖ For example, following the Spanish conquest of the Aztec and Inca empires (between 1519 and 1521), **massive amounts** of gold and especially silver flowed into the **Spanish and other European economies**.

✓ Since the **money supply** had **rapidly increased**, prices spiked and the value of money fell, contributing to **economic collapse**.

Causes of inflation – Excessive money poured into economy

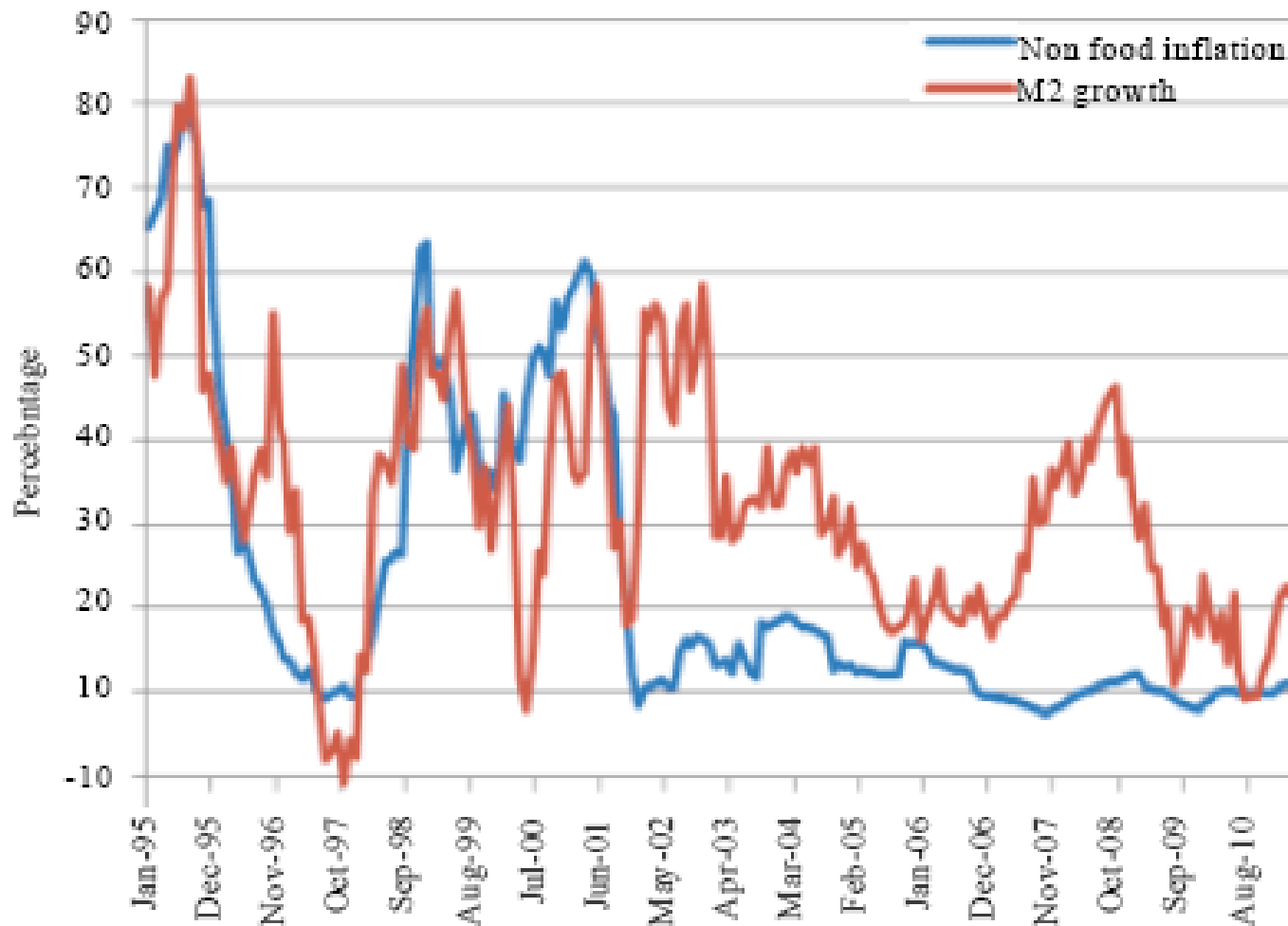
- This is called “Aggregate Demand Curve”

Diagram showing how increased money supply translates into inflation



Causes of inflation – Excessive money poured into economy

- Malawi located in Southern Africa



Causes of inflation – Excessive money poured into economy

Some non-monetarist economists believe **money supply** is **not the reason** for inflation, however it helps other reasons (demand-pull inflation and cost-push inflation)

Causes of inflation – Demand pull inflation

❑ Occurs when the **overall demand** for goods and services in an economy **increases more rapidly** than the **economy's production capacity**.

❖ Example: *oil production cut down.*



Causes of inflation – Demand pull inflation

- ❑ One of the reason can be the **supply of money**.
- ❑ If you **increase** the supply of money evenly, lets say you **double it**,
 - Then that means that **everyone has twice as much money** than they had before, but they still want to buy the same goods.
 - So they can **now afford** to pay twice as **much** as they did before
 - If it happens in a short-time, the **producers cannot satisfy** the demands and the price will **increase**.



Causes of inflation – Cost push inflation

❑ **Cost-push inflation** is a result of **increase** in the prices of **production process inputs**.

❑ **Examples:**

1. Increase in **labor costs** to **manufacture** a good or offer a service.
2. Increase in the **cost of raw material**.

These developments lead to **higher cost** for the **finished product** or **service**, and contribute to inflation.



Causes of inflation – Built-in inflation

- ❑ As the price of goods and services rises, **labor expects and demands more costs/wages** to:
maintain their cost of living.

- ❑ Their **increased wages** result in:
higher cost of **goods** and **services**, and
 the spiral continues as one factor induces the other and **vice-versa**.



Measure to bring inflation down

1. Price and wage control
2. Reducing money supply
3. Credit restrictions
4. Raising taxes
5. Enlarged supply of goods through greater productivity

Measure to bring inflation down – Price and wage control

❑ There are **two methods**:

1. **Price control method**
2. **Wage control method**

❑ The **price and wage control** are **studied conjointly** because whatever is the cause of initial inflation,

1. **Cost-push** inflation
2. **Price-push** (**Built-in**) inflation

go together.

Measure to bring inflation down – Price and wage control

1. Price control method

❑ Under the Price Control Method, there are **fixed retail prices** of goods and services, applicable to all the goods or **partially confined** to those which are scarce and essential for basic livelihood.

❖ The major objective of the **price control** method is to:

1. Prevent the **rise in the prices** of scarce commodities and at the same time
2. Ration the **use of goods** and **services**.

Price control method is quite skeptical because:

- ✓ Often lead to **black-marketing** of **commodities**,
- ✓ **unfair distribution** of **scarce resources**, and
- ✓ **Other** faulty practices,

Especially where the **administration** is inefficient and corrupt.

Measure to bring inflation down – Price and wage control

2. Wage control method

- ❑ The **Wage Control Method** is typically used in the **situation** where the **inflation** is of **cost-push and wage-push** nature.
 - ❖ A **rise** in the **wage rate** is **restricted** through a **ceiling imposed** on the **wage incomes**
 - ❖ This ceiling is called as “**wage-freeze.**”

Measure to bring inflation down – Reducing money supply

- ❑ Directly or indirectly **reduce** the money supply by **enacting policies** that **encourage reduction of the money supply**.
- ❑ The **government** reduces the **supply of money** by **selling bonds**.
 - As banks **buy up these bonds**, they have less money to lend.
 - Since they have **less money to lend**, they increase the interest rate, i.e. the **cost of money**.
 - With the **higher interest rate**, less people and institutions **borrow** money or **borrow less money**.
 - Additionally because of the higher interest rates **more people** and **institutions** **deposit money** in banks to **profit off** of the **higher interest**.
 - If there is **not a lot of money**, demand-pull inflation decreases.

Measure to bring inflation down – Reducing money supply

- ❑ In the short term this means that **businesses** and **people** are spending less of their money which
 1. **Slows down growth**
 2. **Cause recession**

- ❑ In the long term of course, the increases depositing/investing will increase the **money supply** and decrease the interest rates...

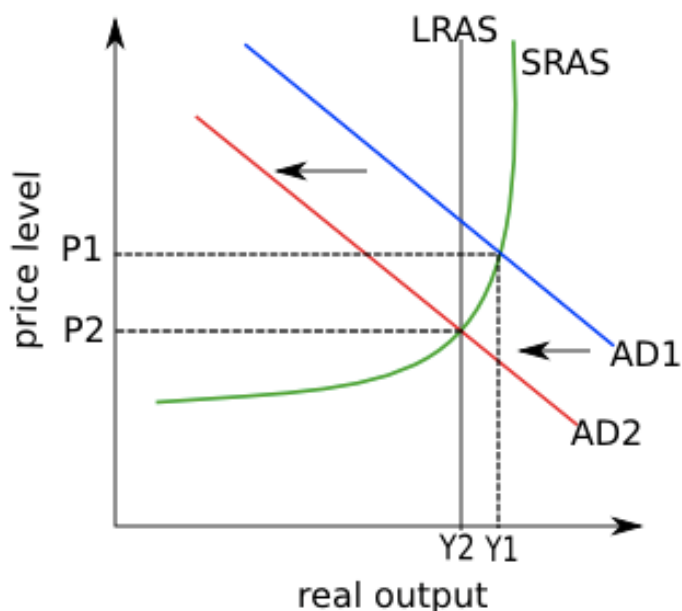
What if we were in recession and we have cost-push inflation?

Measure to bring inflation down – Credit restrictions

- ☐ A **credit limit** is the **maximum amount** of **credit** that a **financial institution** or **other lender** will **extend to a debtor**.
- ☐ **Credit restrictions** also may **limit transactions**.
- ☐ **This policy** is to **control** **demand-pull inflation**.

Measure to bring inflation down – Raising taxes

- ❑ Higher tax rates can be used to control inflation given everything else is constant.
- ❑ It can be explained by taking income taxes into account.
 - ❑ Higher the **income tax rates**
 - Greater the **reduction** in the **income of people**
 - Lower the **money** in the **hands of people**
 - Lower the **demand** of **goods and services**
 - Thus **lower** the **price level** since demand-pull **inflation** is **controlled**.



Measure to bring inflation down – Enlarged supply of goods

- ☐ Very difficult and cumbersome and needs changing the structure of economy.
- ☐ Needs investment in infrastructures and manufacturing.
- ☐ Needs investment in technology and increase in efficiency and productivity.
- ☐ This is a step after using the true policy for inflation control.

Consequences of inflation

1. Standard of living will decline
2. Confidence in economy will decline
3. Business decisions will be distorted
4. Infrastructures will be deteriorated

Measure of inflation

❑ Most commonly used inflation indexes are:

1. **Consumer Price Index (CPI)** (شاخص قیمت مصرف کننده)
2. **Wholesale Price Index (WPI)** (شاخص قیمت عمده فروشی) or **Producer Price Index (PPI)** (شاخص قیمت تولید کننده)
3. **Industrial Price Index (IPI)**

Measure of inflation – CPI

❑ The **CPI** is a measure that examines the weighted average of **prices** of a **basket** of:

1. Goods
2. Services

which are of **primary consumer needs**.

❑ They include **transportation, food** and **medical care**, etc.

❑ It is **widely used** as a measure of inflation

❑ This allows **economists** and **policy makers** to describe economic performance and guide macroeconomic policy.

Measure of inflation – CPI

❑ **Calculating CPI follows a four step process:**

1. Fixing the market basket
2. Calculating the basket's cost
3. Computing the index
4. Computing the inflation rate

Measure of inflation – CPI

1. Fixing the market basket

- ❑ **Basket** includes items from **more than 200 categories** and **eight major groups**: Food and Beverages, Housing, Apparel, Transportation, Medical Care, Recreation, Education and Communication, and Other Goods And Services.
- ❑ The basket is developed over a two-year period from surveys that **collect detailed information** from **households (families and individuals)**:
 1. Everything they buy in a diary for two weeks
 2. Consumption expenses (In second step)

In the **US**, about **7'000 families** from around the **country** provide this data each quarter

Measure of inflation – CPI

1. Fixing the market basket

❑ Data collected **analyzed** to **determine**

1. Weight

2. Importance

of the various items and categories in the **basket**.

❑ **Example:** let's assume that the **typical consumers** in an **economy** **buy a basket** of only two goods on average of:

1. 4 ice cream cones

2. 8 candy bars

Measure of inflation – CPI

2. Calculating the basket's cost

❑ The next step is to **find** the current and previous **prices** of all goods and services.

❖ Hence, the **only variable** is price.

❑ *Revisiting our example:*

❖ In **2017**, an ice cream cone costs USD 2 and a candy bar sells at USD 1.

❖ The basket's cost adds up to:

$$USD\ 16 = 4\ ice\ cream\ cones \times USD\ 2 + 8\ candy\ bars \times USD\ 1$$

❖ Back in **2016**, consumers only had to pay USD 1.90 for an ice cream cone and USD 0.80 for a candy bar, which results in a:

❖ Basket cost of

$$USD\ 14 = 4\ ice\ cream\ cones \times USD\ 1.90 + 8\ candy\ bars \times USD\ 0.8$$

Measure of inflation – CPI

3. Computing the index

□ We need to define a **base year**

- ❖ The **base year** serves as the **benchmark** against which **all other years** are compared.
- ❖ It can be **designated freely**, **although** for the **sake of comparability** it is **common practice** to keep the **same base year** for a **few years** before moving on to a new one.

$$\text{Consumer Price Index (CPI)}_t = \frac{\text{Cost of market basket}_t}{\text{Cost of market basket}_b} * 100$$

Measure of inflation – CPI

3. Computing the index

$$\text{Consumer Price Index (CPI)}_t = \frac{\text{Cost of market basket}_t}{\text{Cost of market basket}_b} * 100$$

❑ To calculate CPI in 2016:

❖ We have to divide USD 14 by USD 14 and multiply the result by 100

$$\text{❖ } (14/14) \times 100 = 100$$

❑ Using the same formula, the CPI in 2017:

$$\text{❖ } (16/14) \times 100 = 114.3$$

Thus we can say that the Consumer Price Index has increased from 100 in 2016 to 114.3 in 2017.

Measure of inflation – CPI

4. Computing the inflation rate

- ☐ Lastly, the **calculated CPI** can be used to **compute** the **inflation rate**.
- ☐ More **specifically**, the **inflation rate** is the **percentage change** in the **price index** from **one period to the preceding one**.
- ☐ To calculate it, we can use the following formula.

$$\text{Inflation rate in year 2} = \frac{CPI_2 - CPI_1}{CPI_1} * 100$$

- ☐ In our example, the inflation rate in 2017 is:

$$\diamond ([114,3-100]/100) \times 100 = 14.3\%$$

Measure of inflation – WPI or PPI

- ❑ The **wholesale price index (WPI)** is another **popular measure of inflation**, which measures and tracks the **changes** in the price of **goods**.
- ❑ While **WPI** items vary from **one country to other**, they mostly include items at **producer or wholesale level**.

Measure of inflation – WPI or PPI

- ❑ Although **many countries** and organizations use **WPI**, **many other countries**, including the **U.S.**, use a similar variant called the **producer price index (PPI)**.
- ❑ The **producer price index** is a family of indexes that **measures the average change** in **selling prices received** by **domestic producers** of **goods** and **services** over time.
- ❑ The **PPI** measures price changes from the **perspective of the seller** and **differs** from the **CPI** which **measures price changes** from the **perspective of the buyer**.

Inflation terminology

1. **Constant dollars** (real dollars, or today`s dollars)

(یعنی مبالغ بدون اثر تورم اعمال شده اند)

2. **Actual dollars** (future dollars, or then-current dollars)

(یعنی مبالغ مطرح شده با تورم میباشند)

***Comparison** has been made on the basis of **constant dollars** so far and should be **converted** to **actual dollars** to include inflation.*

Treating inflation in economic analysis

1. If cash flow is in **“constant \$”**, **compare PW, AE, ... by using MARR (i)**

2. If cash flow is in **“actual \$”** either:

a) **Convert into “constant \$” and compare PW, AE, ...**

Or

b) **Use** $i_f = (1 + i)(1 + f) - 1$ when we have **actual \$ cash flow**, and then **continue in calculating PW, AE, ... by using i_f instead of i (MARR)**

➤ i_f is called:

1. **Actual interest rate**, or
2. **Market interest rate** or
3. **Inflated interest rate**

❑ To convert **“constant \$” to “actual \$”**, multiply “constant \$” by $(1 + f)^n$ or $(F/P, f, n)$

❑ To convert **“actual \$” to “constant \$”**, multiply “actual \$” by $1/(1 + f)^n$ or $1/(F/P, f, n)$

Treating inflation in economic analysis

1. What if the investment is long-term and different inflation exists in each year?

- ☐ Use annual average inflation rate.

2. What if the inflation for cash inflow and outflow is different?

- ☐ Use second method using different f for cash inflow and outflow.

3. What if the inflation is negative?

- ☐ To convert “constant \$” to “actual \$”, multiply “constant \$” by $1/(1 + f)^n$ or $1/(F/P, f, n)$
- ☐ To convert “actual \$” to “constant \$”, multiply “actual \$” by $(1 + f)^n$ or $(F/P, f, n)$

Example 1

Example 1: The data presented below is given in **actual dollars**. Compare the present worth of the two alternatives. The rate of interest is 12%. The rate of inflation is 6%.

- Convert to constant dollar cash flow and then compare present worth.
- Use the "combined interest rate" on the actual dollar cash flow to compare the present worth

	ALTERNATIVE A	ALTERNATIVE B
First Cost	\$10,000	\$14,000
Income 1st yr	\$4,240	\$5,830
Income 2nd yr	\$4,496	\$6,182
Income 3rd yr	\$4,764	\$6,551
Income 4th yr	\$5,048	\$6,941
Salvage Value	\$0	\$0
Service Life	4 yrs	4 yrs

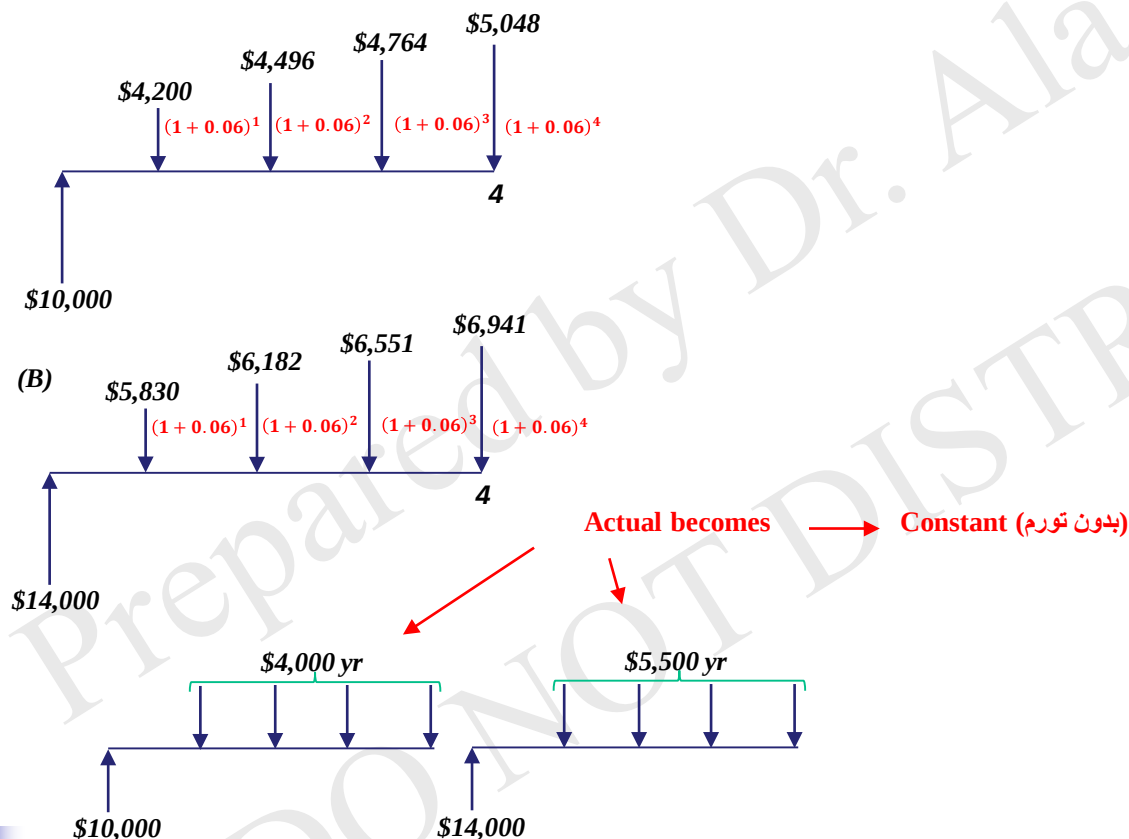
Example 1

a) Convert to constant dollar cash flow and then compare present worth.

ALT (A)

$f = 6\%$

$MARR = i = 12\%$



Example 1

$$Pw_A(12\%) = -\$10,000 + \$4,000 \left(\frac{P}{A}, 12, 4 \right) = \$2,150 \text{ (Constant)}$$

$$Pw_B(12\%) = -\$14,000 + \$5,500 \left(\frac{P}{A}, 12, 4 \right) = \$2,760 \text{ (Constant)}$$

در این حالت ما نرخ ها
را مانند MARR
بدون تورم کردیم.

❖ Select B

Example 1

b) Use the "combined interest rate" on the actual dollar cash flow to compare the present worth

$$i_f = (1 + i)(1 + f) - 1 = (1 + 0.12)(1 + 0.06) - 1 = 18.72\%$$

$$Pw_A(18.72\%) = -\$10,000 + \$4,200 \left(\frac{P}{F}, 18.72, 1 \right) + \$4,496 \left(\frac{P}{F}, 18.72, 2 \right)$$

$$+ \$4,764 \left(\frac{P}{F}, 18.72, 3 \right) + \$5,048 \left(\frac{P}{F}, 18.72, 4 \right) = \$2,150$$

$$Pw_B(18.72\%) = -\$14,000 + \$5,500 \left(\frac{P}{F}, 18.72, 1 \right)$$

$$+ \dots + \$6,941 \left(\frac{P}{F}, 18.72, 4 \right) = \$2,760$$

∴ Select B

در این حالت چون نرخ ها
تورم دار هستند باید از MARR
تورم دار شده استفاده کنیم که i_f است

Example 2

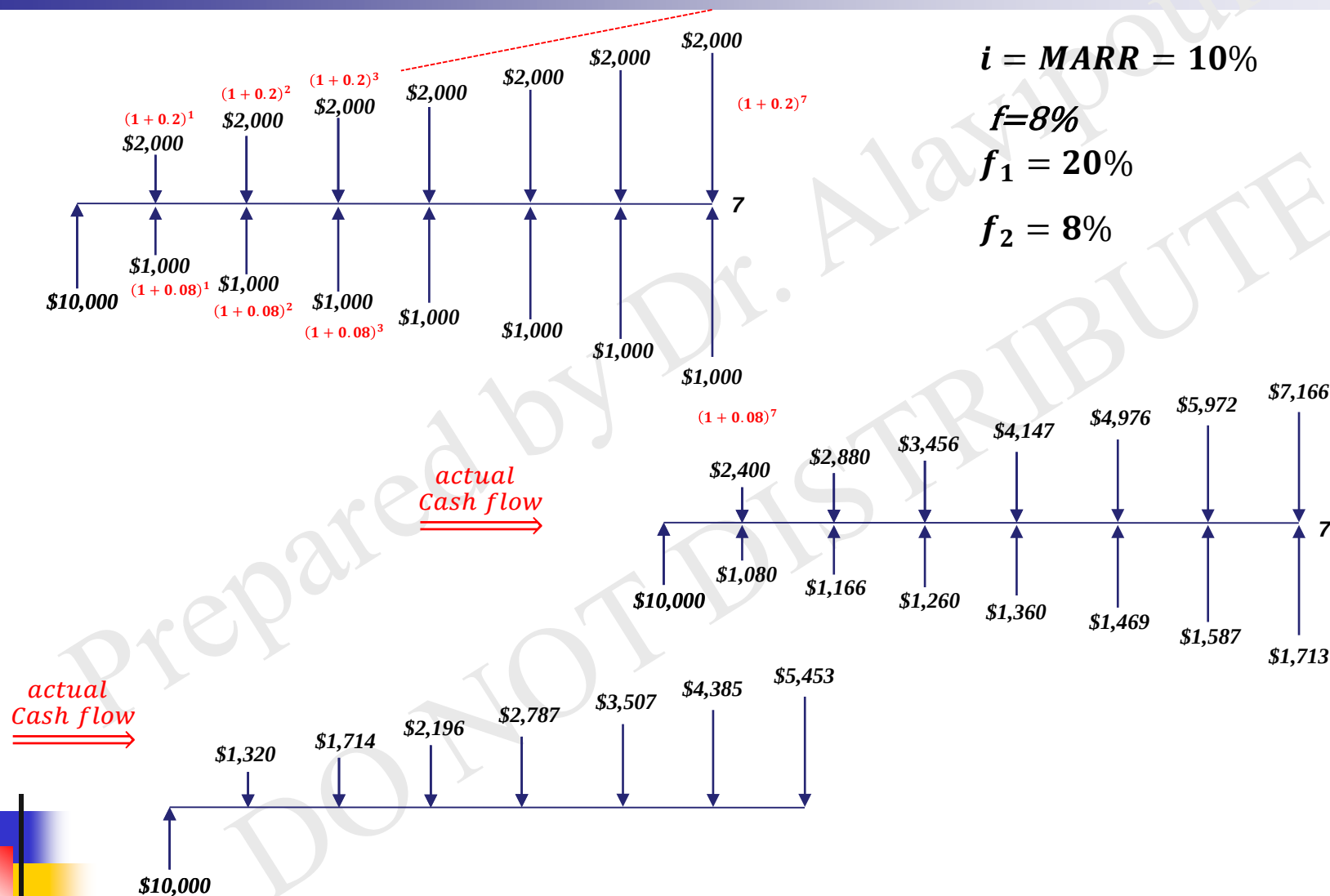
Example 2: The general inflation rate is 8% and the company requires a real rate of return of 10%. A machine purchased for \$10,000 will have no salvage value at the end of its 7-year useful life. It is expected to produce revenue of \$2,000 per year with annual increases of 20% starting the first year. Operating costs are \$1,000 per year but will rise in proportion to the general inflation rate, starting the first year.

Calculate the actual dollar cash flow.

Example 2

رویکردی جامع برای ارزیابی اقتصادی در پروژه همراه با آموزش مدل سازی در اکسل (Excel)
ارزیابی اقتصادی: ارزیابی اقتصادی با در نظر گرفتن تورم

a)



موسسه مهندسی و مدیریت ساخت علوی پور

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بخش هشتم:

ارزیابی اقتصادی: استهلاک و مالیات در ارزیابی اقتصادی

ارائه دهندگان:

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(M.Sc., PMP)

What you will learn?

- ☐ Purpose of this session
- ☐ Purpose of depreciation
- ☐ Commonly used methods
- ☐ Straight line method
- ☐ Straight line method – example
- ☐ Sum of the years method
- ☐ Sum of the years method – example
- ☐ Declining balance method
- ☐ Declining balance method – example
- ☐ Comparison of depreciation methods
- ☐ Selling an asset
- ☐ Depreciation for nontax purposes
- ☐ Income tax
- ☐ Taxable income
- ☐ Taxable income – example
- ☐ Tax consequences of depreciation
- ☐ Tax consequences of depreciation - example

Purposes of the this session

- ❑ Learn the **differences** among the **methods** available for depreciating construction assets, including the **methods** used for **tax purposes**
- ❑ Learn the **fundamentals** of **income tax**
- ❑ Covers the basic principles of income tax.
 - ❖ The **purpose** of this **Section** is to give you a **basic understanding** of the **principles of income tax**, **not turn** you into a tax professional

Purposes of depreciation

❑ For the **owners of depreciable assets**, such as **equipment** and **buildings**, it is important to **estimate the depreciation** of the assets for **four reasons**:

1. Financial statements

❖ The **company's managers** must accurately determine the **value of the company's assets** for **economic analysis**.

2. Cost allocation of equipment

❖ The **cost of owning** of equipment should be **calculated annually** for **economic analysis of equipment**.

3. Project cost determination

4. Taxes

Commonly used methods

1. Straight line method (SL) (روش خط مستقیم یا اقساط مساوی استهلاک)
2. Sum of the years method (SOY) (روش مجموع سنوات)
3. Declining balance method (روش نزولی یا شتابزده استهلاک)
4. MACRS (Modified Accelerated Cost Recovery System)

❑ جدول استهلاکات مالیاتی موضوع ماده ۱۴۹ اصلاحی قانون مالیاتی مستقیم مصوب ۹۴/۰۴/۳۱ (سال و روش برای هر دارایی)

❑ روش اول و سوم در ایران قابل استفاده بوده و روش دوم مرسوم نیست.

❑ هم **سال** و هم **روش** در این جداول برای **هر دارایی** مشخص شده است.

Commonly used methods

❑ Each of these depreciation methods uses the following variables:

- ❖ P = Purchase price
- ❖ F = Salvage Value
- ❖ N = Recovery period (years)
 - ✓ Set by code for tax purposes
- ❖ R_m = Percentage of depreciation taken in year m
- ❖ D_m = Depreciation for year m
- ❖ BV_m = Book value at the end of year m
 - ✓ Book value equals the purchase price less the depreciation recorded to date

Straight line method (SL)

❑ Depreciates **uniformly** over the life of the asset

❑ **Annual depreciation rate**

❖ $R_m = 1 / N$

✓ R_m = Percentage of depreciation taken in year m

✓ N = Recovery period (years)

❑ **Annual depreciation**

❖ $D_m = (P - F) / N$

✓ D_m = Depreciation for year m

✓ P = Purchase price

✓ F = Salvage Value

❑ **Book Value**

❖ $BV_m = P - m (D_m)$ -or- $BV_m = BV_{m-1} - D_m$

Straight line method (SL) – Example 1

- ❑ **Example 1:** A dump truck is **purchased for \$110,000** and has an **estimated salvage value of \$10,000** at the end of the recovery period. Prepare a depreciation schedule for the dump truck using the **straight-line method** with a **recovery period of five years**.

m	R_m	D_m (\$)	BV_m (\$)
0			110,000
1	1/5	20,000	90,000
2	1/5	20,000	70,000
3	1/5	20,000	50,000
4	1/5	20,000	30,000
5	1/5	20,000	10,000

Sum of the years method (SOY)

❑ The sum-of-the-years (SOY) method is used to **accelerate the depreciation** of an asset.

❑ **Annual depreciation**

$$\diamond SOY = N(N + 1) / 2$$

$$\diamond R_m = (N - m + 1) / SOY$$

$$\diamond D_m = (P - F) R_m$$

❑ **Book Value**

$$\diamond BV_m = BV_{m-1} - D_m$$

Sum of the years method (SOY) – Example 2

- ❑ **Example 2:** A dump truck is purchased for \$110,000 and has an estimated salvage value of \$10,000 at the end of the recovery period. Prepare a depreciation schedule for the dump truck using the **sum-of-the-years method** with a recovery period of **five years**.

m	R_m	D_m (\$)	BV_m (\$)
0		0	110,000
1	5/15	33,333	76,667
2	4/15	26,667	50,000
3	3/15	20,000	30,000
4	2/15	13,333	16,667
5	1/15	6,667	10,000

Declining balance method

☐ Accelerates depreciation

- ❖ Double Declining Balance (In Iran)
- ❖ Standard Declining Balance

☐ Annual depreciation

- ❖ $D_m = (BV_{m-1})R_m$
 - ✓ $R_m = 2.00 / N$ for 200% declining-balance
 - ✓ $R_m = 1.50 / N$ for 150% declining-balance
 - ✓ In **Iran** R_m is defined and should be used accordingly.

☐ Book value

- ❖ $BV_m = BV_{m-1} - D_m$

Declining balance method

❑ Does not automatically reach salvage value

1. **Must stop depreciation** at salvage value when

1. **Any year** when *Book value* < *salvage value*

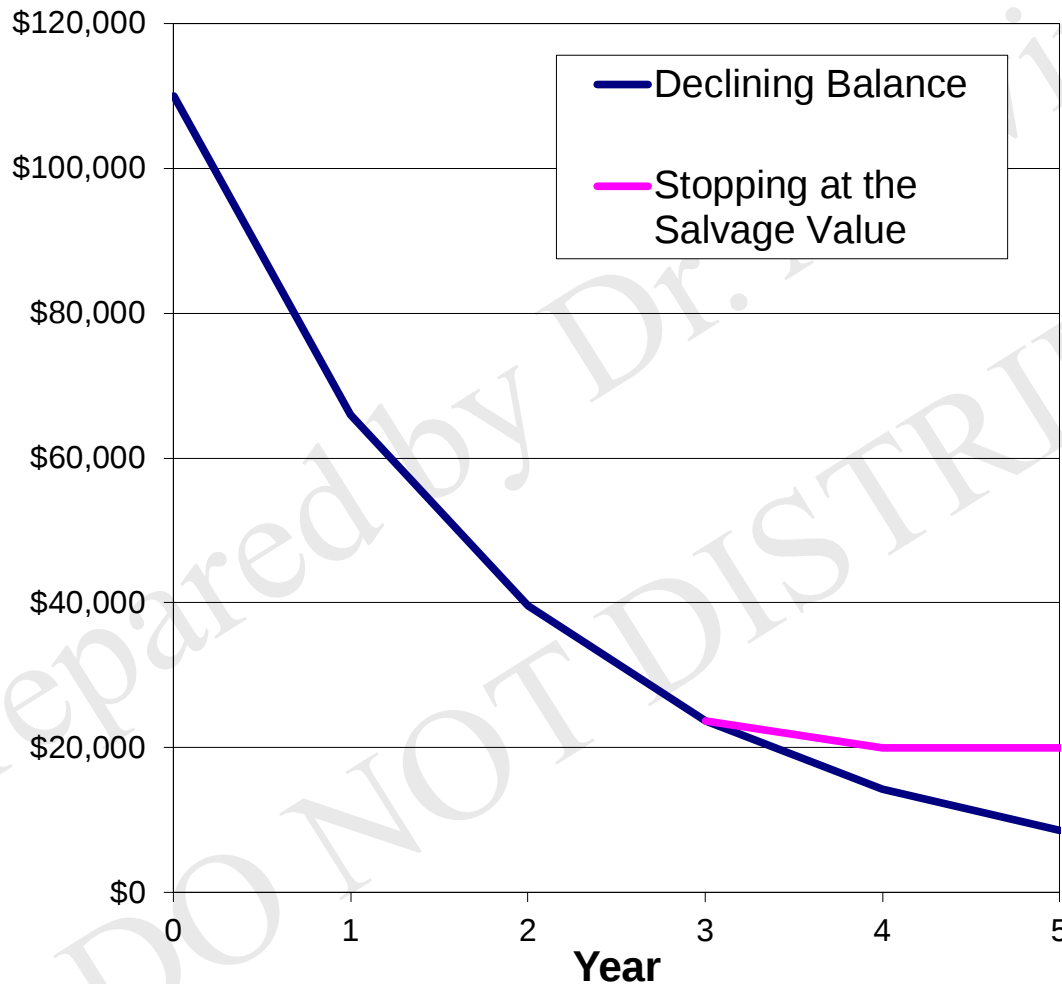
2. If in the **last year** *Book value* > *salvage value*

- OR -

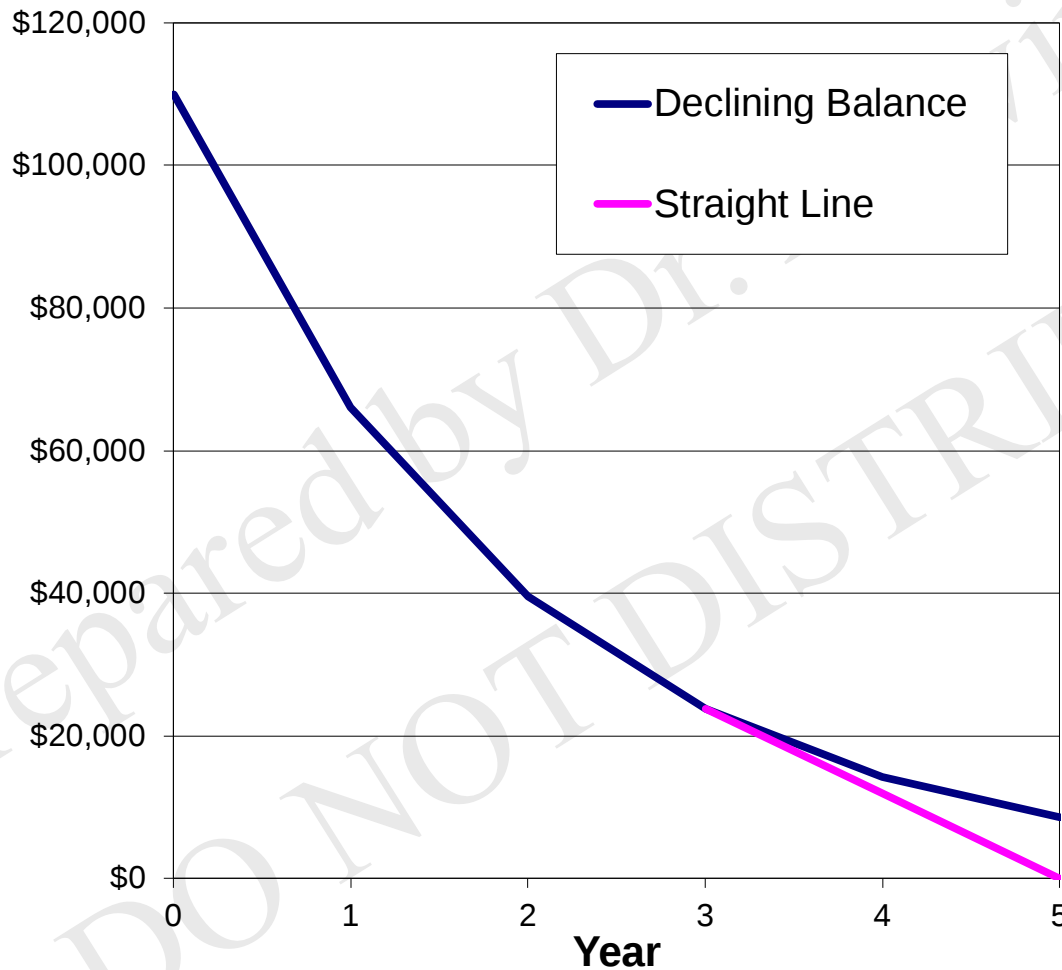
2. Must **switch to straight line depreciation** when

❖ *SL depreciation for the remaining years > declining-balance depreciation*

Declining balance method – Stopping at salvage value (\$20,000)



Declining balance method – Switching to straight line (SV = 0)



Declining balance method – Example 3

- ❑ **Example 3:** A dump truck is purchased for **\$110,000** and has an **estimated salvage value** of **\$10,000** at the end of the recovery period. Prepare a depreciation schedule for the dump truck using the **200% declining-balance** method with a recovery period of **five years**.

m	R_m	D_m (\$)	BV_m (\$)
0		0	110,000
1	0.40	44,000	66,000
2	0.40	26,400	39,600
3	0.40	15,840	23,760
4	0.40	9,504	14,256
5	0.40	4,256	10,000

Declining balance method – Example 4

Example 4: An asset, which has a useful life of 5 years, had an initial value of \$10,000 and a salvage value of \$1,000.

- a) Calculate the yearly depreciations and book values using the double declining balance method of depreciation.
- b) Assume the salvage value is \$1,500. Calculate the yearly depreciations and book values using the double declining balance method of depreciation.

Declining balance method – Example 4

a) Calculate the yearly depreciations and book values using the double declining balance method of depreciation.

$$DDB\ n = 5\ years, \quad P = \$10,000, \quad S = \$1,000, \quad DB\ rate = \frac{2}{n} = 0.4$$

End of year	Yearly depreciation	Book value
0	0	\$10,000
1	$\$10,000 * 0.4 = \$4,000$	$\$10,000 - \$4,000 = \$6,000$
2	$\$6,000 * 0.4 = \$2,400$	$\$6,000 - \$2,400 = \$3,600$
3	$\$3,600 * 0.4 = \$1,440$	$\$3,600 - \$1,440 = \$2,160$
4	$\$2,160 * 0.4 = \864	$\$2,160 - \$864 = \$1,296$
5	$\\$1,296 * 0.4 = \\518 $\$1,296 - \$1,000 = \$296$	$\\$1,296 - \\$518 = \\$778$ 1,000

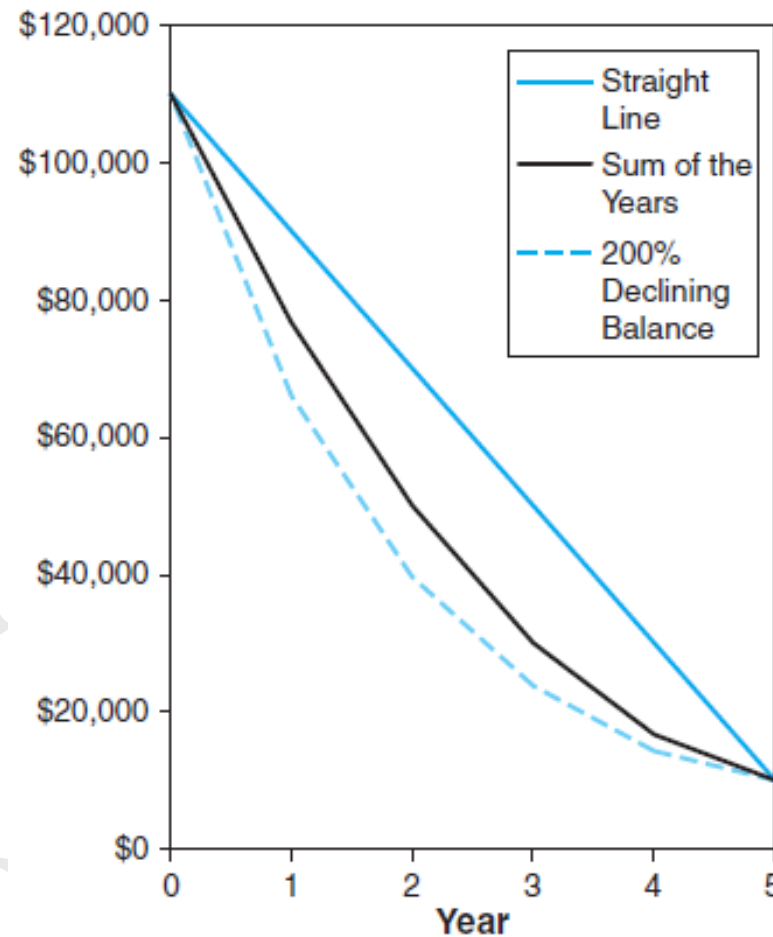
Declining balance method – Example 4

b) Assume the salvage value is \$1,500. Calculate the yearly depreciations and book values using the double declining balance method of depreciation.

$S = \$1500 \rightarrow \text{Greater than 4th \& 5th year} \rightarrow$

$\text{Depreciation in 4th year in depreciation table} = \$2160 - \$1500 = \660

Comparison of depreciation methods



Comparison of Depreciation Methods

Selling an asset

- ❑ When an asset is **sold** for **more or less** than its **book value** that was used for tax purposes, an **adjustment must be made** during the tax year the **asset is disposed of**.

1. Less than book value

- ❖ If an asset is sold < its book value,
 - ✓ The **difference** between the sales price and the book value is recorded as a **loss on the sale of an asset**.

2. More than book value

- ❖ If the asset is sold > its book value,
 - ✓ The difference between the sales price and the book value is recorded as a **gain on the sale of an asset**.

Depreciation for nontax purposes

- ❑ Depreciation may be calculated **differently** for financial statements and for use in the billing of equipment than the depreciation calculated for tax purposes. The calculations **may differ** for any of the following reasons:
1. A different depreciation method is being used.
 2. A different recovery period is being used.
 3. The salvage value has been included in the calculations.
 4. The asset is exempt from depreciation **under law** but is **depreciated** for **other purposes**.
 5. Special depreciation allowances are available for **tax purposes**, which allow even faster depreciation of an asset than is used for **financial purposes**.

Income tax

❑ Corporate income tax (مالیات بر درآمد اشخاص حقوقی)

❖ Pays at:

- ✓ Corporate level
- ✓ Personal level on dividends

❑ Personal income tax (مالیات بر درآمد اشخاص حقیقی)

- ❖ Income tax passes through the company to the individual

Taxable income

- ☐ ***Taxable income = income – tax deductions (such as expenses, interest, depreciation)***
- ☐ **Not all** cost are **tax deductible**
- ☐ **Unused (unallowed) losses** may be **carried forward**

Taxable income – Example 5

- ❑ A construction company is set up as a C corporation. The net income/loss for the first five years of the company's existence **before carrying back or forward** any losses—are as follows: **year 1**, -\$10,000; **year 2**, -\$25,000; year 3, \$20,000; **year 4**, **\$30,000**; and **year 5**, \$35,000.

What is the **taxable income** for the corporation after carrying back or carrying forward any losses for the years?

Taxable income – Example 5

❑ **Solution:** Because the **losses** occur in the **first two years of the company's existence**, the **losses cannot be carried back** and **must be carried forward** until there is a net income to offset the losses.

- ❖ First year, its tax liability is **zero** (-\$10,000).
- ❖ Second year, its tax liability is **zero** (-\$10,000 - \$25,000).
- ❖ Third year, its tax liability is **zero** (\$20,000 - \$35,000 loss).
- ❖ Fourth year, its tax liability is **\$15,000** (\$30,000 - \$15,000 loss).
- ❖ Fifth year, its tax liability is **\$35,000** (\$35,000 - \$0 loss).

Tax consequences of depreciation

- ☐ Spread **tax savings** out **over more years**
- ☐ The **law** specifies the **assumed life of the asset**, as well as the **allowable depreciation methods**
- ☐ These **costs** are then used to
 - ❖ Offset **income**
 - ❖ Reduce **taxable income** and thereby
 - ❖ Reduce **income taxes**

Tax consequences of depreciation – Example 6

- ❑ An excavator with an initial cost of \$100,000 has a **salvage value of \$10,000** at the **end of 3 years**. If the contractor who purchases this excavator earns \$50,000 per year (before depreciation) and if the **effective tax rate** charged from the net income (after depreciation) is 50%, **calculate the taxes** to be paid by the contractor at the end of each year.
- ❖ Determine which method is most **desirable** from the **point of view** of the contractor by computing the **annual equivalent values of the taxes paid**.
 - ❖ Take $i = 12\%$.

Tax consequences of depreciation – Solution – SL method

m	R_m	D_m (\$)	BV_m (\$)	Yearly income (\$)	Taxable income (\$)	Tax
0		0	100,000	0	0	0
1	1/3	30,000	70,000	50,000	20,000	10,000
2	1/3	30,000	40,000	50,000	20,000	10,000
3	1/3	30,000	10,000	50,000	20,000	10,000

❖ Total tax paid = \$30,000

❖ Take $i = 12\%$. $AE(12\%) = \$10,000 / \text{yr.}$

Tax consequences of depreciation – Solution – DDB method

m	R_m	D_m (\$)	BV_m (\$)	Yearly income (\$)	Taxable income (\$)	Tax
0		0	100,000	0	0	0
1	0.6667	66,670	33,330	50,000	-16,670	0
2	0.6667	22,221	11,109	50,000	$27,779 - 16,670 = 11,109$	5,554.5
3	0.6667	1,109	10,000	50,000	48,891	24,445.5

❖ Total tax paid = \$30,000

❖ Take $i = 12\%$. $AE(12\%) = \$9,088 / \text{yr.}$

موسسه مهندسی و مدیریت ساخت علوی پور

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رویکردی جامع برای ارزیابی اقتصادی در پروژه همراه با آموزش مدلسازی در اکسل (Excel)

بخش نهم:

ارزیابی اقتصادی: ارزیابی اقتصادی پروژه های دولتی

ارائه دهندگان:

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(PhD, PMP, CMIT)

کامبیز کردانی

(M.Sc., PMP)

What we will learn?

- ☐ Purposes of this session
- ☐ Public sector projects
 - ❖ Definition
 - ❖ Size of investment
 - ❖ Life estimate
 - ❖ Annual cash flow estimate
 - ❖ Funding
 - ❖ Interest rate
 - ❖ Alternative selection criteria
 - ❖ Environment of the evaluation
- ☐ Public private partnership (PPP)
 - ❖ Definition
 - ❖ Traditional model
 - ❖ Modern model

What we will learn?

- ☐ Benefit/Cost analysis
- ☐ Water Treatment Facility #3 Case
- ☐ Economic analysis of a single project
 - ❖ Definition
 - ❖ Ratio 1
 - ❖ Ratio 2
 - ❖ Ratio 3
 - ❖ How to select?
- ☐ Economic analysis of mutually exclusive projects
 - ❖ How to select?
 - ❖ Example 1
 - ❖ Example 2

Purposes of the this session

- ❑ Previous Sessions applied to **alternatives** in the **private sector**.
- ❑ This Session introduces **public sector** and **service sector alternatives** and their economic consideration.
 - ❖ In the case of **public projects**, the **owners** and **users (beneficiaries)** are the **citizens** and **residents** of a government unit—city, county, state, province, or nation.
- ❑ This Session:
 1. **Introduces** service sector projects
 2. **Discusses** how their **economic evaluation** is **different** from that for **other projects**

Public sector projects – Definition

❑ **Now** we will **explore** projects that concentrate on **government units** and the **citizens** they serve.

❖ These are **called** public sector projects.

A **public sector project** is a product, service, or system used, financed, and owned by the citizens of any government level. The primary purpose is to **provide service to the citizenry for the public good at no profit**. Areas such as public health, criminal justice, safety, transportation, welfare, and utilities are publically owned and require economic evaluation.

Public sector projects – Definition

- ❑ Government units provide the mechanisms to raise capital and operating funds.
- ❖ Public-private partnerships have become **increasingly common**, especially for large infrastructure projects such as:
 - ❖ Major highways,
 - ❖ Power generation plants,
 - ❖ Water resource developments, and
 - ❖ Etc.

Public sector projects – Definition

❑ It is **surprising how much** of what we use on a **daily** or **as-needed** basis is **publicly owned** and **financed** to serve us-the citizenry. These are some **examples**:

- ❖ Hospitals and clinics
- ❖ Parks and recreation
- ❖ Utilities: water, electricity, gas, sewer, sanitation
- ❖ Schools: primary, secondary, community colleges, universities
- ❖ Police and fire protection
- ❖ Courts and prisons
- ❖ Food stamp and rent relief programs
- ❖ Job training
- ❖ Public housing
- ❖ Etc.

Public sector projects – Size of investment

❑ There are **significant differences** in the **characteristics** of **private** and **public** sector alternatives.

1. Size of investment
2. Life estimate
3. Annual cash flow estimate
4. Funding
5. Interest rate
6. Alternative selection criteria
7. Environment of the evaluation

Public sector projects – Size of investment

- ❑ There are **significant differences** in the **characteristics** of **private** and **public** sector alternatives.

Characteristic	Public sector	Private sector
Size of investment	Large	Some large; more medium to small

- ❑ Public projects require **large initial investments**, possibly **distributed** over **several years**.
 - ❖ Modern highways, public transportation systems, universities, airports, and flood control systems are examples.

Public sector projects – Life estimates

- There are **significant differences** in the **characteristics** of **private** and **public** sector alternatives.

Characteristic	Public sector	Private sector
Life estimates	Longer (30–50+ years)	Shorter (2–25 years)

- The **long lives** of **public projects** often prompt the use of the **capitalized cost method**, where **infinity** is used for n and **annual costs** are calculated as **$A = P(i)$**

Public sector projects – Annual cash flow estimates

- ❑ There are **significant differences** in the **characteristics** of **private** and **public** sector alternatives.

Characteristic	Public sector	Private sector
Annual cash flow estimates	No profit; costs, benefits, and disbenefits are estimated	Revenues contribute to profits; costs are estimated

- ❑ **Public sector projects** (also called **publicly owned**) do **not have profits**; they do have **costs** that are paid by the appropriate **government unit**; and they **benefit** the **citizenry**.

- ❖ **Public sector projects** often have **undesirable consequences**, as interpreted by some sectors of the public.
- ❖ The **economic analysis** should consider these **consequences** in **monetary** terms to the **degree estimable**.

Public sector projects – Funding

- ❑ There are **significant differences** in the **characteristics** of **private** and **public** sector alternatives.

Characteristic	Public sector	Private sector
Funding	Taxes, fees, bonds, private funds	Stocks, bonds, loans, individual owners

- ❑ **Taxes** are collected from those who are the **owners—the citizens**
 - ❖ This is **also** the **case** for **fees**, such as **toll road fees** for drivers.
- ❑ **Bonds** are often issued:
 - ❖ U.S. Treasury bonds, municipal bond issues, and special-purpose bonds, such as utility district bonds.
- ❑ **Private lenders** can provide **up-front financing**.
 - ❖ Also, **private donors** may provide **funding** for museums, memorials, parks, and garden areas **through gifts**.

Public sector projects – Interest rate

- ❑ There are **significant differences** in the **characteristics** of **private** and **public** sector alternatives.

Characteristic	Public sector	Private sector
Interest rate	Lower	Higher, based on cost of capital

- ❑ Many **loans** are very **low-interest**, and grants with **no repayment** requirement from **federal programs** may **share project costs**.
- ❑ Some **government** units do **not pay taxes**.
- ❑ The **determination** of the **interest rate** for **public sector** evaluation is as **important** as the determination of the **MARR** for a **private sector** analysis.
- ❑ The **public sector interest rate** is identified as **i** ; however, it is referred to by **other names** to **distinguish** it from the private sector rate.
 - ❖ The **most common** terms are **discount rate** and **social discount rate**.

Public sector projects – Alternative selection criteria

- There are **significant differences** in the **characteristics** of **private** and **public** sector alternatives.

Characteristic	Public sector	Private sector
Alternative selection criteria	Multiple criteria	Primarily based on rate of return

Multiple criteria:

- ❖ **Economic**
- ❖ **Noneconomic**
- ❖ Special-interest political and citizen groups
make the selection of one alternative over another much more difficult.

- Seldom** select an alternative on the **sole basis** of a criterion such as **PW or ROR**.

- It is **important** to **describe** and **itemize** the **criteria** and **selection method** **prior** to the **analysis**.

Public sector projects – Environment of the evaluation

- ❑ There are **significant differences** in the **characteristics** of **private** and **public** sector alternatives.

Characteristic	Public sector	Private sector
Environment of the evaluation	Politically inclined	Primarily economic

- ❑ Elected officials commonly **assist** with the **selection**.
 - ❖ The **selection process** is **not** as “**clean**” as in **private sector evaluation**.

Public-Private Partnership (PPP)

- ❑ Most of the **large public sector projects** are developed through **public-private partnerships (PPPs)**.
- ❑ A partnership is **advantageous** because of (1) the **greater efficiency** of the private sector and (2) the **sizable cost** to **design, construct, and operate such projects**.
- ❑ **Full funding** by the government unit **may not be possible** using **traditional means**—fees, taxes, and bonds.
- ❑ **Some examples** of the projects are as follows:

Project	Some Purposes of the Project
Mass transportation	Reduce transit time; reduce congestion; improve environment; decrease road accidents
Bridges and tunnels	Speed traffic flows; reduce congestion; improve safety
Ports and harbors	Increase cargo capacity; support industrial development; increase tourism
Airports	Increase capacity; improve passenger safety; support development
Water resources	Desalination for drinking water; meet irrigation and industrial needs; improve wastewater treatment

Public-Private Partnership (PPP)

- ❑ In these **joint ventures**, the **public sector (government)** is **responsible** for the **funding** and **service** to the **citizenry**.
- ❑ The **private sector partner (corporation)** is **responsible** for **varying aspects** of the projects as **detailed later** in this session.
- ❑ The **government unit cannot** make a **profit**, **but** the **corporation(s)** involved can realize a **reasonable profit**:
 - ❖ In fact, the **profit margin** is usually **written into the contract** that **governs**:
 1. Design
 2. Construction
 3. Operation

Traditional Public-Private Partnership (PPP)

❑ Traditional methods of **contracting** were:

1. *Fixed-price* (historically called lump-sum)
2. *Cost reimbursable* (also called cost-plus)
3. *Unit price*

❑ In these formats, a **government unit** took **responsibility** for **funding** and possibly some of the **design elements**, and later **all operation activities**,

❖ While the **contractor** did **not share** in the **risks** involved—**liability**, **natural disasters**, **funding shortfalls**, etc.

Modern Public-Private Partnership (PPP)

- ❑ The **PPP** has become the arrangement of **choice** for most large public projects.
- ❑ Commonly these are called design-build contracts, under which **contractors** take on **more and more** of the functions from design to operation.
 - ❖ **Details** are explained in **publications** such as *Design-Build Contracting Handbook* (Cushman and Loulakis).
 - ❖ The **most reliance** is placed upon a contractor or contractors with a **DBOMF contract**, as described below.

The **Design-Build-Operate-Maintain-Finance (DBOMF)** contract is considered a turnkey approach to a project. It requires the contractor(s) to perform all the DBOMF activities with collaboration and approval of the owner (the government unit). The activity of **financing** is the *management of cash flow to support project implementation* by a contracting firm. Although a contractor may assist in some instances, the **funding** (obtaining the capital funds) remains the government's responsibility through bonding, commercial loans, taxation, grants, and gifts.

- ❖ Not financed by contractor = DBOM
- ❖ Not financed and not operate = DB

Modern Public-Private Partnership (PPP)

- ❑ The **amount of funding** committed to the project **may not cover** the **actual build cost** because it is considerably **higher than estimated**.
- ❑ A **reasonable profit** may **not** be **realized** by the **private corporation** due to **low usage** of the **facility** during the **operate phase**.

HOW TO SOLVE?

- ❑ To **prevent** such **problems**, the **original contract** may provide for **special subsidies** and **loans guaranteed** by the **government unit**.
 - ❖ The **subsidy** may **cover costs plus** (**contractually agreed-to**) **profit** if **usage** is **lower** than a **specified level**.
 - ❖ The **level used** may be the **breakeven point** with the **agreed-to profit margin** considered.

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