

8.1 Concept of Inflation:

- Inflation is loss in purchasing power of money over time i.e. cost of an item tends to increase over time.
- If consumers of an economy come to know that price are going to increase in coming future then they will over purchase the goods. This will cause the shortage of goods in market.

8.2 Measuring Inflation:

- The consumer price index (CPI) compare the cost of typical market cost of goods & services in current month with each cost one month before.
- The point in the past to which current price are compared is called base period.
- Market basket normally consist of item from several groups such as:
 - Housing, fooding
 - Entertainment
 - Medical care, etc.

Terminologies on Inflation

Consumer Price Index (CPI):

The CPI measures the average change in the price paid for food, shelter, medical care, transportation, and other goods & services used by individual & families.

II. Producer Price Index (PPI) :

The PPI is good measure of industrial price increase. It is also called as WPI.

III. Wholesale Price Index (WPI)

It measures and tracks the change in price of goods in the stage before the retail level.

IV. Gross Domestic Product (GDP) :

The total value of all final goods & services produced within that economy during a specified period.

Basic terms:

a) Actual/ Future dollar (A\$)

Estimate of future cash flow, that takes into account any anticipated change in amount due to inflation or deflation effect.

b) To this ^{base} year dollar estimate.

c) Constant/ Base year dollar (A'\$)

Represent constant purchasing power independent of time.

$$A\$ = A' \$ (1+f)^n$$

Q Price \$114.3 in 1967, \$43.97 in 2000. What is the average inflation rate (f)?

Here,

$$A\$ = \$43.97$$

$$A'\$ = \$114.3$$

$$\begin{aligned} n &= (2000 - 1967) \\ &= 33 \end{aligned}$$

$$A\$ = A'(\$ (1+f)^n)$$

$$\frac{A\$}{A'\$} = (1+f)^{33}$$

$$8.25 = (1+f)^{33}$$

$$\begin{aligned} f &= \log_{1.066} 8.25 - 1 \\ &= \sqrt[33]{8.25} - 1 \\ &= 0.066 \\ &= 6.6\% \end{aligned}$$

Q. Find the rate of inflation per year when price of product has increased from \$5,00,000 to \$6,30,000 over the period of 3 years.

Here,

$$A\$ = \$6,30,000$$

$$A'\$ = \$5,00,000$$

$$n = 3 \text{ years}$$

$$A\$ = A'(\$ (1+f)^n)$$

$$f = \sqrt[3]{\frac{6,30,000}{5,00,000}} - 1 = 8.0\%$$

i) Inflation rate per year: 8%

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$$= 2.67\% \text{ p.a}$$

8.4 Economic Equivalence under inflation:

i) Market Interest rate (i):

It is all the interest rate stated by the financial institution for loan & saving account.

ii) Real/Inflation free Interest Rate (i'):

It is the estimate of true earning power of money when inflation effect has been removed.

iii) Inflation Rate (f):

This is the measure of rate of change in the value of money.

Note:

Conversion from Actual to constant dollar.

$$A' \$ = A \$ (1+f)^{-N}$$

Conversion from constant to Actual

$$A \$ = A' \$ (1+f)^N$$

Convert the project cash flow into the equivalent actual dollar. Inflation rate: 5%



Period	0	1	2	3	4
Net cash flow in constant dollar	-45,000	2,00,000	2,20,000	2,20,000	2,30,000

Period	Constant state \$ A'\$	Actual \$ (A\$)
0	-45,000	-45,000
1	2,00,000	2,10,000
2	2,20,000	242550
3	2,20,000	254677.5
4	2,30,000	279566.4375
5		

Q. The project is expected to generate the following cash flow: in actual \$.

Year	0	1	2	3	4
Actual \$	7,50,000	3,20,000	3,57,000	3,28,000	2,90,000

What are the equivalent constant dollar if $f = 5\%$
 Compute the present worth (PW) of these cash flow in a constant dollar if $i = 10\%$.

Here,

$$P = F(1+i)^{-n} ; P = \text{Present Worth}$$

$$F = \text{Constant \$}$$

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Year	Actual \\$	Constant \\$	Present worth
0	- 7,50,000	- 7,50,000	- 7,50,000
1	8,20,000	3,04,761.90	2,77,056.27
2	3,57,000	3,23,809.52	2,67,611.17
3	3,28,000	2,83,938.73	2,12,876.5815
4	2,90,000	2,38,583.71	1,62,955.88

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Adjusted Discount Method:

$$A' \$ = A \$ \quad \dots \dots \dots \quad (1)$$

$$(1+f)^n (1+i')^n$$

From Market Interest Rate.

$$A' \$ = A \$ \quad \dots \dots \dots \quad (II)$$

$$(1+i)^n$$

From (I) and (II)

$$\frac{A \$}{(1+f)^n (1+i')^n} = \frac{A \$}{(1+i)^n}$$

$$(1+f)^n (1+i')^n = (1+i)^n$$

$$(1+f) (1+i') = 1+i$$

$$\text{or, } 1+i + i' + f + i' \times f = 1+i$$

$$\text{or, } i' + (1+f) = i - f$$

$$i' = \left(\frac{i - f}{1+f} \right)$$

Calculate inflation free interest rate (implied interest)
when inflation rate is 5% & market interest rate is
18% per year.

Hence,

$$P = F \left(\frac{1+i}{1+f} \right)^N$$

$$P = A \left[\frac{(1+i)^N - 1}{(1+i)^N \times i} \right]$$

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$$i' = \frac{i-f}{1+f}$$

$$= \frac{13.5}{17.5} \frac{0.13 - 0.5}{1+0.5}$$

$$= 7.07\% \text{ //}$$

For Annual Cost:

$$P = A \left[\frac{(1+i')^N - 1}{(1+i')^N \times i'} \right]$$

For Salvage value

$$P = F (1+i')^{-N}$$

- Q. Evaluate the PW of the following project:

Initial investment = Rs. 1,00,000

Annual sales income = Rs. 40,000

Annual labour cost = Rs. 3,000

Annual material cost X = Rs. 2,000

Annual material cost Y = Rs. 1,000

Salvage value = 20% of initial investment

All are given in constant dollar.

Inflation rate for sales income, labour cost, material X, material Y and salvage value are 5%, 8%, 0%, 6% & 8% respectively for the project period. Take market interest rate = 8% and project life is 4 years.

S.No	Items	$i' = \frac{i-f}{1+f}$	Cash Flow	PW
1.	Investment	0	-1,00,000	-1,00,000
2.	Annual sales income	0.143	40,000	1,15,835.834
3.	Annual labour cost	0.111	-3,000	-9,287.49
	Annual material X cost	0.2	-2,000	-5,177.469
	Annual material Y cost	0.132	-1,000	-2,962.158
	Salvage value.	0.165	20,000	36841.19
				10857.41

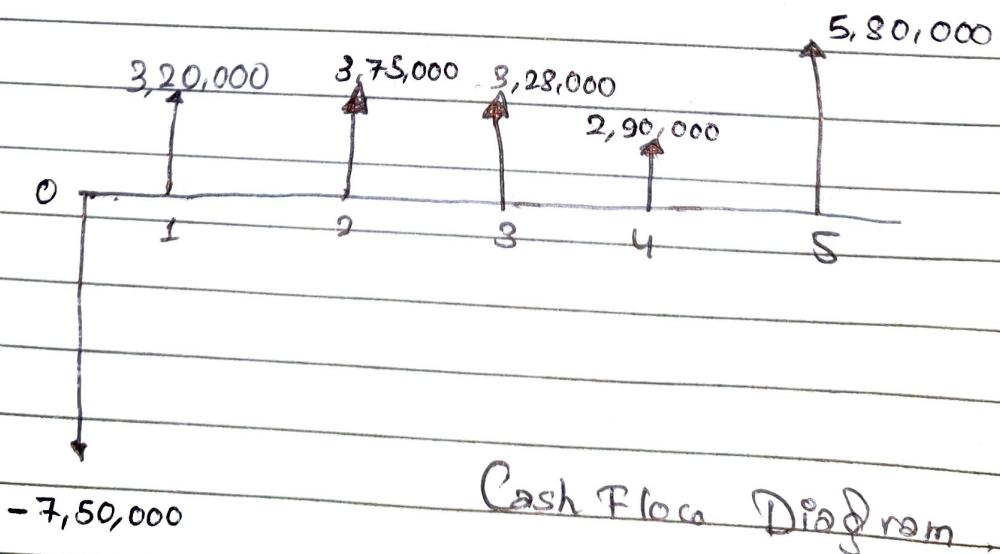
$$\begin{aligned}
 PW = & -1,00,000 + A \left(\frac{P}{A}, i\%N \right) - A \left(\frac{P}{A}, i\%N \right) - A \left(\frac{P}{A}, i\%N \right) \\
 & - A \left(\frac{P}{A}, i\%N \right) + F \left(\frac{P}{F}, i\%N \right)
 \end{aligned}$$

To

$$\begin{aligned}
 PW = & -1,00,000 + 1,15,835.34 - 9,287.49 - 5177.469 \\
 & - 2962.153 + 10857.4 \\
 = & 9265.64
 \end{aligned}$$

Q. Calculate PW equivalent Present worth (PW) of the project from the following cash flow assuming inflation free interest rate as 5% and inflation as 10%.

EOY	Cash Flow in Actual \$
0	- 7,50,000
1	3,20,000
2	3,75,000
3	3,28,000
4	2,90,000
5	5,80,000

Soln:

$$i' = \frac{i-f}{1+f}$$

$$i' = \frac{i-0.1}{1+0.1}$$

$$0.05 \times 1.1 + 0.1 = i'$$

$$i' = 0.155 ; 15.5\%$$

Now

$$P = F(1+i)^{-N}$$

Now

EOY	Actual \$ (F)	$P = F(1+i)^{-N}$
0	-7,50,000	-7,50,000
1	3,20,000	2,77,056.277
2	3,75,000	2,81,104.177
3	3,28,000	2,12,876.583
4	2,90,000	1,62,955.889
5	580,000	282,174.700

Now, Equivalent PW:

$$\begin{aligned}
 & -7,50,000 + 2,77,056.277 + 2,81,104.177 \\
 & + 2,12,876.583 + 1,62,955.889 + \\
 & 2,82,174.700 \\
 & = 4,66,167.626
 \end{aligned}$$