

decisions and will lead to misallocation of resources.

- When inflation distorts relative prices, consumer's and producer's decisions are distorted and it leads to misallocation of resources.

### \* Measuring Inflation

- Inflation occurs when general price level rises continuously.
- General price level is obtained as a weighted average of the individual goods' prices.

$$P_t = \sum_{i=1}^n w_i P_{it}$$

$P_t$  = general price in time period t

$P_{it}$  = price of good i at period t.

$w_i$  = weight of good i

n = no. of goods and services in the economy.

$$w_i > 0 \quad \sum_{i=1}^n w_i = 1$$

### \* Example

Goods	Price (2011) (Rs)	Weight
wheat	30/kg	0.5
Cloth	400/piece	0.4
Trade	2000/month	0.1

- General price level in 2011 =

$$0.5(30) + 0.4(400) + 0.1(2000) = 375.$$

- The weight for a particular component item can be derived by the relative significance of that item in all the items during the base year:

$$W_i = \frac{Q_{i0} P_{i0}}{\sum_i Q_{i0} P_{i0}}$$

$Q_{i0}$  = Quantity of commodity  $i$  in the base year.

$P_{i0}$  = Price of commodity  $i$  in the base year.

- General price level in itself is meaningless.
- It carries significance in the computation of inflation rate, which is better approached through a price index.
- Price index expresses the current price in relation to its value in the base year.
- The price index in period  $t$  can be defined as

$$PI_t = \frac{P_t}{P_0}$$

- If the price of a product in the base

year 2011 was 120 and in the 2016, it becomes 200, the price index for the year 2016 will be  $200/120 = 1.67$ .

- This indicates that the price of the product has increased by 67% over the base year.
- Price index is better for ~~on~~ the price of an individual good. For general price, which is a weighted average of various prices, the price index can be computed as

$$PI_t = \sum w_i \left[ \frac{P_{it}}{P_{i0}} \right]$$

- Substituting the value of  $w_i$ ,

$$PI = \left[ \frac{Q_{i0} P_{i0}}{\sum_i Q_{i0} P_{i0}} \right] \left[ \frac{P_{it}}{P_{i0}} \right]$$

- Solution of this will give

$$PI_L = \frac{\sum Q_{i0} P_{it}}{\sum Q_{i0} P_{i0}} \quad \text{Laspeyres index}$$

- Since weighing pattern has been suggested by Laspeyres, it is called Laspeyres's Index. In this case, base year's quantity is considered.

- Alternatively, Paasche's index can be estimated as

$$PI_P = \frac{\sum Q_{it} P_{it}}{\sum Q_{it} P_{i0}} \quad \text{Paasche's index}$$

- Laspeyres's index takes base year quantities, while Paasche's index takes current year quantities.

### \* Comparison between two indices

- In the base year, we consider a fixed basket of goods & we find the price index & inflation rate corresponding to that fixed basket of goods.
- Laspeyres's index measures changes in the cost of the fixed basket of goods from a base year.
- It assumes no substitution due to relative price changes. it considers the base year's quantity.
- It usually overestimates price today.
- Paasche's index assigns weights by current consumption pattern. It tends to overstate substitution. It underestimates the price index relative to the base year.
- Consumption basket changes over time.
- As a solution to over or underestimation, there are other indices proposed.

• Fisher Ideal Index  $P_f = \sqrt{PIL \times PIP}$   
 (geometric mean of the two)

\* Selection of a Base Year: The Key Criteria

- A Normal Year (no abnormalities in trade, production, price level and price variations)
- A year in which reliable production, price and other required data are available.
- A year as latest as possible and comparable with the other data series.

\* Wholesale Price Index (WPI).

- WPI measures the change in the prices of goods before the retail level.
- Retail level is the stage at which the retailer buys the good. Before that many transactions happen and they are the wholesale transactions.
- This refers to goods that are sold in bulk and traded between businesses.
- Includes prices of raw materials, semi-finished goods, imported tangible goods.
- Includes also prices of tangible goods if

transacted at the wholesale level.

- Excludes prices of all services - education, health, banking, transport and communication. The services does not have any wholesale transaction. ∵ they are not considered.
- For agriculture, marketed surplus is in use not marketable surplus. The output that is truly marketed or sold becomes the marketed surplus. But the whole output that could be marketed is the marketable surplus.
- Weighted arithmetic Mean and Laspeyres formula are used. i.e. substitution is not permitted, fixed basket of goods from the base year ~~are~~ is considered.
- The office of the Economic Adviser in the Department of Industrial Policy and Promotion Ministry of Commerce & Industry is responsible for compiling WPI & releasing it.
- Example:

$$\text{Base } 2011-12 = 100$$

The weight of primary products is generally more than fuel & power. Maximum weightage is given to manufactured products.

Major Group/Group All commodities	Weight	No. of items		No. of Quotations	
		2011-12	2004-05	2011-12	2004-05
I) Primary articles	100	100	697	676	8331 5482
II) Fuel & Power	22.618	20.118	117	102	983 579
III) Manufactured products	13.152	14.910	16	19	442 72
	64.231	64.972	564	555	6906 4831

- Primary articles: food, non-food, minerals, crude petroleum and natural gas
- Fuel and Power: coal, mineral oils, electricity
- Manufactured products: food, beverages, tobacco products, textiles, wearing apparel, leather and related products, wood and wood products, paper and paper products, printing and reproduction of recorded media, chemical and chemical products, Pharmaceuticals, rubber and plastic, other non-metallic mineral products, computer, electronic products, etc.

### \* Consumer Price Index (CPI)

- It captures the price of the consumer goods & services.
- Wholesale price index affects the producers while CPI affects the consumers.
- The CPI is the measure of the average price paid by consumers (retail price) for a basket

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of consumer goods & services.

- A price index is constructed by weighing each price according to the economic importance of the commodities in question.
- Includes prices of services.
- Excludes prices of capital goods (plant and equipment), raw-materials, intermediate goods. Because these goods are not demanded by the consumers, they are demanded by the producers to use further in the process of production.
- On the other hand, in the estimation of WPI, more weightage is given to producer goods.
- ∴ If inflation rate is estimated on the basis of WPI, then consumer goods are not captured & vice-versa. ∴ these inflation rates does not tell the impact on the economy as a whole.

$$\frac{\text{price of basket of goods \& services in current year}}{\text{price of basket in base year}} \times 100 = CPI$$

## \* Types of CPI

- CPI for Industrial Workers (CPI-IW): Labour Bureau, Ministry of Labour.
- CPI for Urban Non-Manual Employees (CPI-UNME) (50% or more income from non-manual work outside agriculture): CSO
- CPI for ~~agricultural~~ agricultural labourers (CPI-AL): Labour Bureau, Ministry of Labour.
- These are first done at the state level and at select centres.
- CPI-IW is a tool to fix the DA (Dearness Allowance) for the workers.
- Aggregation is done ~~as~~ as the weighted arithmetic mean of the respective indices with weights taken as proportional to the aggregate expenditure of the state/centre in all India figure.
- Laspeyres Index is used. For deciding weights of individual goods/services, surveys are conducted across the country.

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• CPI - IW : Group Weights

Group	1960-100	1982 - 100	2001 -100
IA - Food	60.9	57.0	46.2
IB - Pan, Supari, Tobacco & Intoxicants	4.8	3.15	2.27
II - Fuel & Light	5.8	6.28	6.43
III - Housing	6.3	8.67	15.27
IV - Clothing, Bedding & Footwear	8.5	8.54	6.57
V - Miscellaneous	13.7	16.36	23.26
Total.	100.0	100.0	100.0

★ GDP deflator

- It is the index of average price of all goods and services produced in the country (consumption, investment, govt purchases, and net exports). It is calculated by dividing nominal GDP by real GDP multiplied by 100.
- Includes all final goods.  
Excludes intermediaries and raw materials

$$\frac{\text{Nominal GDP} \times 100}{\text{Real GDP}} = \text{GDP deflator}$$

Nominal GDP  $\rightarrow$  GDP measured at current price

Real GDP  $\rightarrow$  GDP measured at constant or base year's price.

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deflator

- In India, GDP ~~inflation~~ data are available on an annual basis.
- It is based on Paasche's Index, as current quantity is being considered.

Year	Nominal GDP	Real GDP	GDP deflator
2012	$10 \times 10000 + 120 \times 400$ $+ 780 \times 50 = 187000$	$10 \times 10000 + 120 \times 400$ $+ 780 \times 50 = 187000$	1
2020	$15 \times 12000 + 200 \times 500$ $+ 1000 \times 75 = 355000$	$10 \times 12000 + 120 \times 500$ $+ 780 \times 75 = 238500$	1.489

- Inflation can be classified into three categories according to its severity: low inflation, galloping inflation and hyperinflation.
- Low inflation: low inflation is characterized by prices that rise slowly and ~~per~~ predictably. When prices are relatively stable, people trust money because it retains its value from month to month and year to year.
- Galloping inflation: also called very high inflation, when inflation rate becomes double-digit or triple-digit percent per year. Galloping inflation is relatively ~~common~~ common particularly in countries suffering from weak governments, war or revolution.

- Hyperinflation: Hyperinflation is more dangerous than galloping inflation. In this situation, the real money stock falls drastically and relative prices become highly unstable.

### \* Inflation Induced Tax Distortions

- If inflation is not fully indexed i.e. the tax system and other parameters are not changed corresponding to the inflation rate.
  - Bracket creep
  - Capital Gain Tax
  - Tax treatment on interest income.

### \* Bracket creep

- In case of progressive tax system, as income of an individual increases, tax imposed on them increases.
- A movement to higher tax brackets as taxable income increases.

### \* Ex:

Up to 1.5 lakh	NIL
1.5 to 3 lakh	10%
3 to 5 lakh	20%
above 5 lakh	30%

- If taxable income is Rs. 4.5 lakh: Income tax will be Rs 45000.
- If inflation rate be 20%, taxable income increases by 20%.

$$4.5 = \cancel{1.5} + 3 \text{ lakh} \quad 3 \text{ lakh} + 1.5 \text{ lakh}$$

~~for 3 lakh  $\Rightarrow 10\%$~~

After 3 lakh, for remaining  $\cancel{+5 \text{ lakh}} \Rightarrow 20\%$ .  
for 1.5 lakh  $\Rightarrow$  no tax.

On the additional 1.5 lakh, above 1.5 lakh  $\Rightarrow 10\%$   
 $\Rightarrow 15000$

On the remaining 1.5 lakh, above 3 lakh  $\Rightarrow 20\%$   
 $\Rightarrow 30000$

Total = ₹ 45000.

- When the ~~#~~ inflation rate rises, dearness allowance (DA) rises in compensation to the loss in purchasing power of the consumers due to higher prices.
- And as tax is levied on the nominal income & not on the real income,  $\therefore$  as nominal income will rise, tax will rise.

- If inflation rate be 20%, taxable income increases by 20%. Total income becomes Rs 5.4 lakh: Income Tax becomes Rs 67000.

$$1.5 \Rightarrow 0$$

$$1.5 L \Rightarrow 10\% \quad 15000$$

$$2 L \Rightarrow 20\% \quad 40000$$

$$0.4 L \Rightarrow 30\% \quad 12000$$

$$67000$$

- Increase in tax by 28% but inflation has increased by 20%.
- If the tax is fully inflation indexed, the tax brackets are fully index i.e. then the increase in tax would have been 20%.
- But in this case, tax has not been fully inflation indexed because when inflation is increasing by 20%, tax is increasing by 28%.
- In order to make tax increase by 20%, the income tax brackets should also be revised by 20%.

Up to 1.8 lakh	<del>10% + 2%</del> Nil
1.8 to 3.6 lakh	<del>20%</del> 10%
3.6 to 6.4 lakh	20%
Above 6 lakh	30%

- The tax brackets should be updated to the above values. If the tax brackets are not revised, percentage increase in tax is greater than that of income. If tax is not fully inflation indexed, then when inflation rises, increase in tax is greater than that in income. This is called bracket creep.
- Even when DA is increased corresponding

to greater inflation rate, if the tax is not inflation indexed, then people move up to higher tax bracket & people suffer all the same due to inflation.

### \* Capital Gain Tax \*

- Stock purchased at Rs 100. after a year, its nominal value becomes Rs 200.  
 $\therefore$  Capital gain in the year = Rs 100.  
 Inflation rate: 20%  
 Capital gain tax: 20%  
 $\text{Capital gain} * \text{tax} = \text{Rs } 20 [=(200 - 100)(0.2)]$
- If the stock is fully inflation indexed,  
 capital gain index = Rs 16  
 $[=(200 - 100 \times 1.2)(0.2)]$
- The capital gain from stock can be considered as an interest income : it should be inflation indexed.
- If the capital gain is not inflation index, then the real gain will be less than the nominal gain as it should be deflated by the inflation rate. and a large part of the gain will go in tax.

- ★ Tax treatment on interest income.
- The interest earned by deposits in bank is the interest income.

	USA	India
Real interest rate	4% <del>8%</del>	4%
Inflation rate	0	8
Nominal interest rate (real interest rate + inflation rate)	4	12
Reduced interest due to 25% tax. ( $0.25 \times \text{nominal rate}$ )	1	3
After tax nominal interest rate ( $0.75 \times \text{nominal rate}$ )	3	9
After-tax real interest rate (after-tax nominal interest rate - inflation rate)	3	1

- After tax real income is much lower in India compared to USA because of high interest rate.
- Countries with higher inflation rate suffer more than the countries with lower inflation rate.
- Countries with higher inflation rate have lower deposits in banks which have adverse consequences.

- \* ~~Redistribution~~
- \* Redistribution of wealth.

~~Expected~~ Expected Inflation: 0

Nominal interest = Real interest = 4%

Actual inflation = 6%.

Borrowing = Rs 10000 for a year

Return = 10400 after a year.

Purchasing power of Rs 10400 after a year

$$= \frac{10400}{1.06} = 9811.$$

At the time of lending, inflation was zero  
 $\therefore$  Real income was equal to nominal income but after a year, the return is less than ~~the~~ the real income that was lent.

9811  $\rightarrow$  This is less than the purchasing power of Rs 10000 before a year. In this case, borrower gains from the whole transaction. & lender is in loss.

If there had been ~~no~~ deflation, borrower will loose & lender will gain.

- \* Arbitrary redistribution of wealth.

Inflation causes additional costs when it is unexpected.

Unexpected inflation redistributes wealth

arbitrarily.

There is redistribution of wealth between creditors and debtors.

If inflation can be predicted, both could take inflation into account when setting the nominal interest rate.

If it is not predictable, it imposes a risk on either or both.

### \* Inflation and Foreign Exchange Rate

If a good sells at Rs 500 in India and \$10 in USA, the nominal exchange rate  $E$  is  $\text{Rs } 500 = \$10$ .

$E = 500/10$  (Units of domestic currency per unit of foreign currency).

$$E = \text{Price at home} / \text{Price abroad}$$

Real exchange rate ( $e$ ) is obtained by adjusting nominal interest rate to the change in relative inflation in two countries.

$$e = E \left( \frac{1 + p'}{1 + p^o} \right)$$

$e \rightarrow$  real ~~inter~~ exchange rate

$E \rightarrow$  nominal exchange rate.

$$E = e \left( \frac{1+p^o}{1+p^i} \right)$$

$p^o$  = inflation rate in India (Domestic country)  
 $p^i$  = inflation rate in USA. (abroad)

Suppose.  $p^o = 10\%$ ,  $p^i = 2\%$

Nominal exchange rate remaining at 50 per dollar,  $e = 50 \left( \frac{1.02}{1.10} \right) = 46.36$  (appreciation by 8%).

~~Since real exchange rate~~  
 when there is an appreciation in the currency, it creates a disincentive effect on export. The country will gain as an importer but loose as an exporter.

Since real exchange rate affects net exports, the nominal rate is adjusted to neutralize the effects of the differing inflation rates.

Depreciation of the Indian currency by 8% from 50 to 53.92 is required.

### Inflation tax.

When the government raises revenue by printing new money, it is considered to levy an inflation tax. When the govt prints money, the price level rises, and hence the value of the dollar one hold decreases.