



# PRICE CHANGES AND EXCHANGE RATES

# **GENERAL PRICE INFLATION**

**An increase in the average price paid for goods and services bringing about a reduction in the purchasing power of money.**

# **GENERAL PRICE DEFLATION**

**A decrease in the average price paid for goods in services, resulting in an increase in the purchasing power of money.**

# **CONSUMER PRICE INDEX (CPI)**

- **One measure of price changes in our economy**
- **An estimate of general price inflation**
- **Tabulated by the U S Government**
- **A composite price index that measures price changes in food, shelter, medical care, transportation, apparel, and other selected goods and services used by average individuals and families**

# CONSUMER PRICE INDEX

$$\text{CPI}_k = (\sum Q_{k-1} \times P_k) / (\sum Q_{k-1} \times P_{k-1})$$

- $Q_{k-1}$  = Preceding year quantities
- $P_k$  = Current-year prices
- $P_{k-1}$  = Preceding Year Prices

## CPI Annual Inflation Rate

$$= [ (\text{CPI}_k - \text{CPI}_{k-1}) / \text{CPI}_{k-1} ] \times 100$$

- $\text{CPI}_k$  = Consumer price index for the current year
- $\text{CPI}_{k-1}$  = Consumer price index for the preceding year

# **OTHER INFLATION INDICATORS**

- While the CPI is shows how the prices that consumers pay change from year to year or month to month**
- The PPI (Producer Price Index) shows how the prices paid to producers change from year to year or month to month**
- The Implicit Price Deflator or GDP deflator shows how all prices in the economy change from one time period to another time period**

# INFLATION-RELATED TERMINOLOGY

- Actual dollars (A\$) - (Current time frame) cash-flow dollars : also current dollars, then-current dollars, or inflated dollars
- Real dollars (R\$) - Dollars in terms of purchasing power at some stated time period (i.e., base year): also constant dollars
- Base period (b) - Purchasing-power time reference
- General price inflation ( f ) - Measure of change in purchasing power from one time to another
- Combined (nominal) interest rate (  $i_c$  ) - Market interest rate: actual dollars paid for use of capital
- Real interest rate - (  $i_r$  ) - Inflation-free interest rate: real dollars paid for use of capital

# RELATING ACTUAL DOLLARS TO REAL DOLLARS

- Use the following to convert actual dollars, as of time  $k$ , to real dollars of constant purchasing power

$$\begin{aligned} (R\$)_{K} &= (A\$)_{K} [1 / (1+f)]^{K-b} \\ &= (A\$)_{K} (P / F, f \%, k-b) \end{aligned}$$

- The equation changes as follows for a specific type cash flow (i.e. specific good or service “ $j$ ” )

$$\begin{aligned} (R\$)_{Kj} &= (A\$)_{Kj} [1 / (1+f)]^{K-b} \\ &= (A\$)_{Kj} (P / F, f \%, k-b) \end{aligned}$$

- In the base period, purchasing power of actual dollar and real dollar are the same



# RELATING COMBINED AND REAL INTEREST RATES AND GENERAL INFLATION RATE

$$i_r = (i_c - f) / (1 + f)$$

- Similarly, current-dollar internal rate of return is related to the real rate of return in the following way:

$$IRR_r = (IRR_c - f) / (1 + f)$$

# **FIXED AND RESPONSIVE ANNUITIES**

- **Cash flows predetermined by contract -- bonds or fixed annuities -- do not respond to general price inflation**
- **Future amounts that are not predetermined may, by varying degrees, respond to general price inflation**

# CALCULATING AN EFFECTIVE GENERAL PRICE INFLATION RATE

- $\bar{f}$  = An (estimated) effective general price inflation rate for a period of N years

$$\bar{f} = \left[ \prod_{k=1}^N (1 + f_k) \right]^{1/N} - 1$$

# DIFFERENTIAL PRICE INFLATION

- Variation between general price inflation rate and the best estimate of future price changes for specific goods and services
- $e_j^l$  -- The increment ( % ) of price change above or below the general price inflation rate for a given time period for good or service “  $j$  ”
- Caused by: changes in supply, changes in demand, technological improvements, productivity changes, regulatory requirements

# TOTAL PRICE ESCALATION

- Price changes caused by some combination of general price and differential price inflation
- $e_j$  -- The total rate (%) of price change during a time period for good or service “ $j$ ”
- Includes the effects of both the general price inflation rate ( $f$ ) and the differential price inflation rate ( $e_j^l$ ) on price changes

$$e_j^l = (e_j - f) / (1 + f)$$

$$(A\$)_{kj} = (A\$)_{bj} (F / P, e_j \%, k - b)$$

$$(A\$)_{bj} = (A\$)_{bj} (F / P, e_j^l \%, k - b)$$

# DETERMINING A CONVENIENCE RATE FOR GEOMETRIC CASH FLOW SEQUENCES

- Actual dollar analysis ( A\$ )

$$i_{CR} = ( i_c - e_j ) / ( 1 + e_j )$$

- Real dollar analysis ( R\$ )

$$i_{CR} = ( i_r - e_j^l ) / ( 1 + e_j^l )$$

# MARKET INTEREST RATE RATE OF RETURN RELATIVE TO U.S. DOLLARS

$$i_{f_c} = i_{US} + f_e + f_e (i_{US})$$

$$i_{US} = (i_{f_c} - f_e) / (1 + f_e)$$

- $i_{US}$  = market (combined) interest rate of return relative to US dollars
- $i_{f_c}$  = market (combined) interest rate of return relative to foreign country currency
- $f_e$  = Annual rate of change in exchange rate -- annual devaluation rate -- between foreign country currency and US dollar
  - $f_e$  +: foreign currency devalued relative to dollar
  - $f_e$  -: dollar devalued relative to foreign currency