

Topic: The Impact of Inflation on CFs, interests rates, and PVs

1. Definitions:

- { **Inflation** - Rate at which prices as a whole are increasing
- { **Deflation** - Rate at which prices as a whole are decreasing

Inflation means a drop in the purchasing power of money. If goods cost \$100 last year and \$103 today, we have 3% inflation.

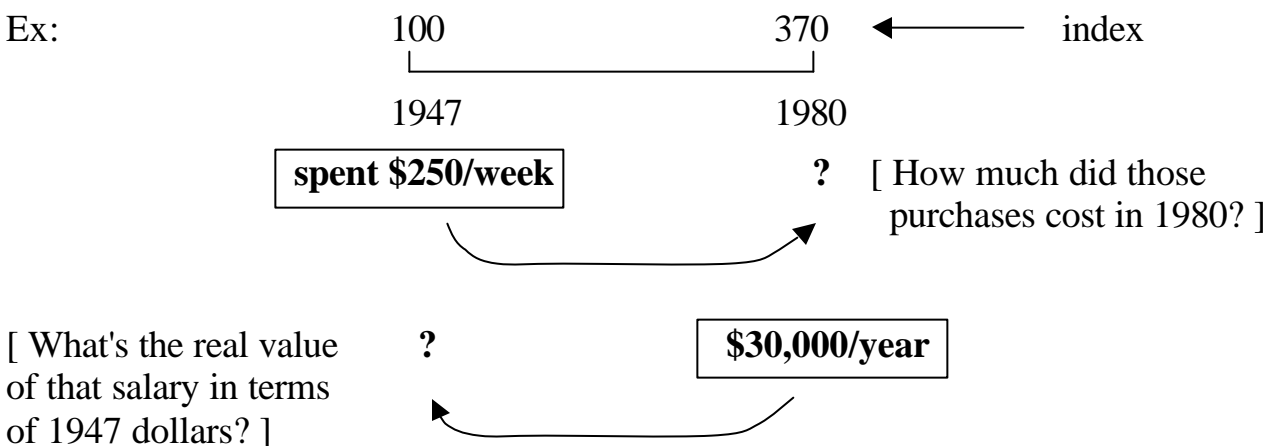
2. CPI: Consumer Price Index

- Most commonly used measure of inflation.
- Based on changes in prices of a standard basket of goods. Some say that it overstates the inflation because it doesn't allow for substitution.

You calculate inflation the same way you calculate interest.

Ex: 4% inflation for 10 years → \$100 of goods in 10 years will cost \$148 [= $100 \cdot (1.04)^{10}$]

- ### 3. { **Nominal dollars:** Not adjusted for inflation
- { **Real dollars:** Adjusted for inflation



- ### 4. { **Nominal Interest Rate:** Not adjusted for inflation
- { **Real Interest Rate:**
- The rate at which the purchasing power of an investment increases
 - The nominal rate adjusted for inflation.

$$1 + \text{Real Interest Rate} = \left(\frac{1 + \text{Nominal Interest Rate}}{1 + \text{Inflation Rate}} \right)$$

Approximation: Real Interest Rate = Nominal Interest Rate - Inflation rate

Example: I_n (Nominal interest rate) = 7%

i (Inflation) = 3%

What is the real interest rate (I_R) ?

$$\frac{1.07}{1.03} = 1.0388 \rightarrow \text{Real rate} = 3.88\%$$

Approximation: $7\% - 3\% = 4\%$

Why is inflation important in interest rates?

Save to buy a car - The car costs \$17,250 today.

You can save \$3,000/yr. for 5 years with 7% interest to get \$17,250

Future value of annuity = 5.7507

But, in 5 years, with 2% inflation, the car costs $\$17,250 * (1.02)^5 = \$19,045$

If inflation expectations increase, nominal interest rates increase in order to maintain purchasing power behind real interest rates. Note the book says inflation but it's really inflation expectations since the rates declared in the present are matched with inflation in the future.

1970's - Interest rates of 15%, but inflation was 11%

1980's - Inflation fell faster than expected - thus real rates were very high.

Now we have lower interest rates due to lower inflation expectations.

Other factors influence nominal interest rates, but inflation expectations is the biggest influence.

You must account for inflation in any problem involving the time value of money.

You must either adjust the dollars or the interest rate.

Back to our car problem:

If the price of the car is \$17,250 in current dollars, and I can save for 5 years to get it, how much do I save per year if the nominal interest rate is 7% and the inflation rate is 2%?

1. $\$17,250 (1.02)^5 = \$19,045$

2. $\$19,045 = C * \left[\frac{(1.07)^5 - 1}{.07} \right]$ so, $C = \$3,312$

\$3,312/yr for 5 years becomes \$19,045 which is what the car price will be at that time.

The most important time to consider inflation is in **retirement planning**.

I'm 30 and plan to retire at age 55

I want \$30,000/yr forever (I think I'll live forever), but what I really want is what \$30,000/yr can buy me today.

Inflation is expected to be level at 3%

Interest rates are 10%

How much must I save per year?

Real Interest Rate: $\frac{1.1}{1.03} = 1.068 \Rightarrow$ real return = 6.8%

To get a \$30,000/yr perpetuity - in real dollars:

$\frac{\$30,000}{\text{Real Int. Rate}} = \frac{\$30,000}{.068} = \$441,176 =$ approx. \$441,000

So I need \$441,000 of today's dollars at age 55 to be able to consume at \$30,000 (today's dollars) per year forever.

To get \$441,000 of today's dollars, what I'll actually need is \$923,356 at age 55.

$$441,000 (1.03)^{25} = 923,356$$

I must save \$X/yr. to get to \$923,356 in 25 years.

We can most easily do this as the **Future value of an annuity**.

$$923,356 = C * \left(\frac{(1.1)^{25} - 1}{.1} \right)$$

$$C = \$9,388.75$$

So, if I save \$9,388.75 per year for 25 yrs. at 10%, I'll have \$923,356.

But due to inflation, the \$923,356 will only be worth the equivalent of \$441,000.

However, this will be enough to generate (at 10% interest with 3% inflation), a perpetuity worth the equivalent of \$30,000 per year.