Inflation, Nominal and Real Returns

Inflation is the increase in the general level of prices in an economy.

Positive inflation reduces the buying power of money.

Nominal returns measure proportional dollar increases in wealth. Most returns or interest rates quoted by banks are nominal rates. Assume that all rates are nominal unless specifically stated.

Real returns measure proportional increases in the *buying power* of your wealth (in goods or services such as apples). Gross Domestic Product (GDP) growth is one of few rates that economists normally quote as a real rate rather than a nominal rate.

Fisher Formula Converts Nominal to Real

The approximate version of the Fisher equation is easy to remember but is not exact ($\approx$ means approximately equal to):

$$r_{real} \approx r_{nominal} - r_{inflation}$$

The exact Fisher equation is: $1 + r_{real} = \frac{1+r_{nominal}}{1+r_{inflation}}$

Note: The rates used in these equations should be effective rates, not APR's.

The Fisher equations only work with the total or capital returns, they don't work with the income (dividend or rental) returns. To find the real income return, you can discount the income cash flow by the inflation rate.

Calculation Example: Inflation Erodes Nominal Wealth

Question: You currently have $**100** in a bank deposit paying **8**% pa interest. Apples currently cost $**1** each at the shop and inflation is **3**% pa which is the expected apple price growth rate. Find the missing variables $\boldsymbol{V}$, $\boldsymbol{P}$, $\boldsymbol{n}$ and $\boldsymbol{r_{real}}$ in 1 and 2 years.

Wealth in Dollars and Apples

Time (years)	Bank account wealth ($)	Apple price ($/apple)	Wealth in apples (apples)	$r_{nominal}$ (pa)	$r_{inflation}$ (pa)	r_{real} (pa)
0	100	1	100			
1	$\boldsymbol{V_1}$	$\boldsymbol{P_1}$	$\boldsymbol{n_1}$	0.08	0.03	$\boldsymbol{r_{real\ 0\rightarrow1}}$
2	$\boldsymbol{V_2}$	$\boldsymbol{P_2}$	$\boldsymbol{n_2}$	0.08	0.03	$\boldsymbol{r_{real\ 1\rightarrow2}}$

Answer: Let's work out the figures at time 2.

Bank wealth $V_{T\ nominal}$ grows by the 8% pa nominal interest rate:

$$V_{T\ nominal} = V_0.(1 + r_{nominal})^T$$

$$V_{2\ nominal} = 100 \times (1 + 0.08)^2 = 116.64$$

The apple price $P_{T\ nominal}$ grows by the 3% pa inflation rate:

$$P_{T\ nominal} = P_0.(1 + r_{nominal})^T$$

$$P_{2\ nominal} = 1 \times (1 + 0.03)^2 = 1.0609$$

The number of apples n_T at time 2 equals nominal bank wealth divided by the nominal apple price:

$$n_T = \frac{V_{T\ nominal}}{P_{T\ nominal}}$$

$n_2 = \frac{116.64}{1.0609} = 109.9443868$ apples, a measure of real wealth.

Use the exact Fisher formula to find $\boldsymbol{r_{real\ 1\to2}}$:

$$1 + r_{real} = \frac{1+r_{nominal}}{1+r_{inflation}}$$

$$1 + r_{real\ 1\to2} = \frac{1+0.08}{1+0.03}$$

$$r_{real\ 1\to2} = \frac{1.08}{1.03} - 1 = 0.048543689$$

Wealth in Dollars and Apples						
Time (years)	Bank account wealth ($)	Apple price ($/apple)	Wealth in apples (apples)	$r_{nominal}$ (pa)	$r_{inflation}$ (pa)	r_{real} (pa)
0	100	1	100			
1	108	1.03	104.8544	0.08	0.03	0.048544
2	116.64	1.0609	109.9444	0.08	0.03	0.048544

Notice that the real return between time 1 and 2 can also be found by calculating the growth rate of your wealth in apples:

$$r_{real\ 1\rightarrow 2} = \frac{n_2}{n_1} - 1 = \frac{109.9443868}{104.8543689} - 1 = 0.048543689$$

This makes sense since your wealth in apples is a real measure of wealth.

Wealth in Dollars and Apples

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Confusion: The Term 'Nominal' is Ambiguous

Be aware that Annualised Percentage Rates (APR's) are also sometimes called 'nominal rates' even though they have nothing to do with the concept of inflation.

This is very confusing. In these notes, when a 'nominal rate' is mentioned, it means a rate that is not adjusted for inflation.

Unfortunately many writers do not explicitly specify which definition of 'nominal' they are using so you have to infer the meaning based on the context.