Real/Nominal GDP Reference[1]
Instructional Primer[2]

Real $GDP_{current}$ = $GDP_{current}$ at base year prices

Example

Year	Nominal GDP (billions)	CPI (1990 base)
1990	5,708	100
2000	9,898	131.75
2010	14,149	166.87

Inflation Rate (based on Δ in CPI) = $\frac{P_2 - P_1}{P_1}(\mathbf{100})$

1990 – 2010 Gross Inflation Rate = $\frac{CPI_2 - CPI_1}{CPI_1}(100) = \frac{166.87-100}{100}(100) = 66.87\%$

Average Annual Inflation Rate = $\frac{Gross\ Inflation\ Rate}{\#\ years} = \frac{66.87}{20} = 3.34\%$

Real GDP = Nominal GDP @ Base Year Prices = $\frac{Nominal}{1+Gross\ Inflation\ Rate}$

% Δ Nominal GDP = $\frac{GDP_2^{Nominal} - GDP_1^{Nominal}}{GDP_1^{Nominal}}(100)$

% Δ Nominal GDP 1990–2000 = $\frac{GDP_{2000}^{Nominal} - GDP_{1990}^{Nominal}}{GDP_{1990}^{Nominal}}(100) = \frac{9898-5708}{5708}(100) = 73.41\%$

% Δ Real GDP = $\frac{GDP_2^{Real} - GDP_1^{Real}}{GDP_1^{Real}}(\mathbf{100})$

% Δ Real GDP 1990-2000 = $\frac{GDP_{2000}^{Real} - GDP_{1990}^{Real}}{GDP_{9901}^{Real}}(100) = \frac{7512-5708}{5708}(100) = 31.6\%$

[1] This primer is intended to present an abbreviated discussion of the included economic concepts and is not intended to be a full or complete representation of them or the underlying economic foundations from which they are built.

[2] This primer was developed by Rick Haskell (rick.haskell@utah.edu), Ph.D. Student, Department of Economics, College of Social and Behavioral Sciences, The University of Utah, Salt Lake City, Utah (2013)

Year	Nominal GDP (billions)	Real GDP (1990 base)	% Δ Nominal	% Δ Real
1990	5,708	5708	--	--
2000	9,898	7512	73.41%	31.6%
2010	14,149	8479	42.95%	48.55%
Δ 1990-2000			147.88%	48.55%

GDP Deflator = $\frac{\boldsymbol{Nominal\ GDP}}{\boldsymbol{Real\ GDP}}\ (\mathbf{100})$

GDP Deflator 1990 = $\frac{Nominal\ GDP^{1990}}{Real\ GDP^{1990}_{1990\ base}}\ (100) = \frac{5708}{5708}\ (100) = 100$ - *what you'd expect for the base year*

GDP Deflator 2000 = $\frac{Nominal\ GDP^{2000}}{Real\ GDP^{2000}_{1990\ base}}\ (100) = \frac{9898}{7512}\ (100) = 131.75$

GDP Deflator 2010 = $\frac{Nominal\ GDP^{2010}}{Real\ GDP^{2010}_{1990\ base}}\ (100) = \frac{14149}{8479}\ (100) = 166.87$

It's not coincidental that the GDP deflator looks a lot like the CPI. Given that they have the same base year in these examples we would expect them to be the same

Year	Nominal GDP (billions)	Real GDP (1990 base)	% Δ Nominal	% Δ Real	GDP Deflator	CPI (1990 base)
1990	5708	5708	--	--	100	100
2000	9898	7512	73.41%	31.6%	131.76	136.75
2010	14149	8479	42.95%	48.55%	166.87	166.87
Δ 1990-2000			147.88%	48.55%		

Unlike some price indices (like the CPI), the GDP deflator is not based on a fixed basket of goods and services. The basket is allowed to change with people's consumption and investment patterns (specifically, for GDP, the "basket" in each year is the set of all goods that were produced domestically, weighted by the market value of the total consumption of each good.) Therefore, new expenditure patterns are allowed to show up in the deflator as people respond to changing prices. The theory behind this approach is that the GDP deflator reflects up to date expenditure patterns. For instance, if the price of ribs increases relative to the price of chicken, it is claimed that people will likely spend more money on chicken as a substitute for ribs. Which is okay I guess, as long as you use the right BBQ sauce and smoke them long enough with the right kind of wood: apple and hickory for ribs, mesquite for chicken.

In practice, the difference between the deflator and a price index like the Consumer price index (CPI) is often relatively small. On the other hand, with governments in developed countries increasingly utilizing price indexes for everything from fiscal and monetary planning to payments to social program recipients, the even small differences between inflation measures can shift budget revenues and expenses by millions or billions of dollars.