# Currency conversion note

While consumers (generally) make decisions based on current domestic currency (or local currency units, LCU) values and exchange rates, when we want to compare prices, GDP, etc., over time and across countries, we need a common currency unit and year. This note walks through the conversion from local, nominal currencies to a common, constant currency. It also describes how to do this conversion when the currency is provided in nominal common currency.

## Constant currency units

In order to compare the real value of GDP or prices in different years, we deflate values to a specific year using calculated rates of inflation.

(1)

Where,

*P* is the price of

commodity, *i* (I’ve dropped the *i*'s for simplicity)

in country, *r*,

*LCU* is the domestic currency,

*t* is the year of interest,

*t\_base* is the currency year where *D* = 100, and

*D* is the GDP deflator in the local currency for *r*.

In this notation, is the 2005 price in constant 2010 Yen.

## Common currency

Similarly, we often want to compare across regions, which requires converting currencies. is the value of one region’s LCU in the base region’s LCU in year *t*. The exchange rates applied to current LCU will provide current (nominal) base currency units (e.g., $):

(2)

## Constant, common currency

How do we put these two together to get constant currency units across countries and over time? The World Bank defines the constant US$[[1]](#footnote-1) as preserving the growth rates in constant LCU, multiplied by the exchange rate in the base year:

*“Our constant U.S. dollar price series preserve the growth rates exhibited in the constant local price series. We first create an index by dividing each year of the constant local price series by its 2010 value (thus, 2010 will equal 1).”*

*(3a)*

*“Then we multiply each year's index result by the corresponding year 2010 current U.S. dollar price value. Dollar figures are converted from local currencies using year 2010 official exchange rates.”*

*(3b)*

This can be re-written as:

***(3c)***

For example, converting the 2005 price of (rice) in Japan in 2005¥ to constant 2010$ would be:

*(4)*

This preserves the buying power of domestic currency over time within a country, but expresses it in a common currency year to compare across countries. There are a few important things worth calling out:

1. When expressed in a real, common currency, the ratios of prices in two countries in a given year will depend on what the base year and base currency is.
2. Once converted in to a real, constant currency, it is possible to express the values in a different currency or year, but that doesn’t change the base year and currency. In other words, prices converted to constant 2010$ could be *expressed* in 2018$ by multiplying by the US deflator, but these would still be constant 2010$, *not* constant 2018$. To convert to 2018$ requires country-specific deflators (see below).

The last point is important when combining data across sources. If one set of data is provided in constant 2005$ and another in constant 2010$, these cannot be made consistent by multiplying by the US deflator.

## Converting to constant, common currency from nominal, common currency

When data are provided in nominal, common currency (e.g., nominal $), these can be converted to constant currency using ***country-specific deflators*** (FAO provides these) or they can be calculated using the ratio of exchange rates and the deflator. (The following can be derived by substituting the nominal common currency divided by the current exchange rate for nominal domestic currency in *Eq. 3c*.)

*(5a)*

Or in actual currencies and years:

*(5b)*

*[Need to make sure the multiplication and division aren’t reversed, but that’s generally correct.]*

These country-specific deflators should always be used when converting between a constant, common currency in one year and another (e.g., prices in Japan given in 2005$ need to be converted to 2010$ using . Using the US deflator would result in constant 2010$ for the US only. The values in other countries would be constant 2005$ adjusted for US inflation through 2010.

## Additional (possibly useful) information and notes on data files

<https://datahelpdesk.worldbank.org/knowledgebase/articles/114942-what-is-the-difference-between-current-and-constan>

# **What is the difference between current and constant data?**

Data reported in current (or “nominal”) prices for each year are in the value of the currency for that particular year. For example, current price data shown for 1990 are based on 1990 prices, for 2000 are based on 2000 prices, and so on. Other series in World Development Indicators (WDI) show data in "constant" or "real" terms. Constant series show the data for each year in the value of a particular base year. Thus, for example, data reported in constant 2010 prices show data for 1990, 2000, and all other years in 2010 prices.

Current series are influenced by the effect of price inflation. Constant series are used to measure the true growth of a series, i.e. adjusting for the effects of price inflation. For example (using year one as the base year), suppose nominal Gross Domestic Product (GDP) rises from 100 billion to 110 billion, and inflation is about 4%. In real prices, the second year GDP would be approximately 106 billion, reflecting its true growth of 6%.

Except for rare instances of deflation (i.e. negative inflation), a country's current price series on a local currency basis will be higher than its constant price series in the years succeeding the constant price base year. However, this relationship does not hold when the data are converted to a common currency such as U.S. dollars. Many countries have had large devaluations of their currency since 1995 (particularly since 1998), which may cause the current dollar series to be lower than the constant dollar series.

Please note that the term "real" has a different meaning when considering data in Purchasing Power Parity (PPP) terms. While "nominal" GDP in the International Comparison Program does refer to the regular national accounts GDP in current prices, "real" GDP is considered to be the PPP GDP in current prices. We also show PPP GDP in constant prices by simply applying the regular national accounts growth rates for GDP to derive the series for PPP GDP in constant 2011 U.S. dollars.

**OECD constant currency conversion**

Data acquired 17 May 2019: <https://stats.oecd.org/index.aspx?queryid=61429#>

See *currency\_conversion\_oecd.xls* that confirms this method reproduces reported constant values. The derived country-specific deflators, calculated using *Eq. 5a* above, for 2010USD are identical to the provided values by FAO (blue highlighted cells in each file).

1. <https://datahelpdesk.worldbank.org/knowledgebase/articles/114943-what-is-your-constant-u-s-dollar-methodology> [↑](#footnote-ref-1)