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## What is an Index Number?

Index numbers are used frequently by economists and it is important to understand the meaning of an index number and how such a thing might be calculated. Index numbers are especially useful in comparing changes in a variable or variables when the magnitude (size) of the numbers change over time.

What are index numbers? Index numbers are calculated from the values of other numbers. Index numbers are dimensionless. That is, index numbers have no units of measurement. In many cases, index numbers are weighted averages –much like a grade point average.

### Example 1: Converting a time series to an index number.

For this example, we will use US Real Gross Domestic Product from 1985 to 1995. All index numbers have a base period –a year, a month, a quarter. In this case the base year is 1990. The value of the index in 1990 was constructed as:

$$\text{Index 1990} = (\$7,112.5 / \$7,211.5) \times 100.0 = 100.0$$

Notice that when we divide dollars by dollars, the result is a number without a unit of measurement.

The other values of the index number were calculated in the same way. That is, each year's value of USRGDP was divided by the base year value of USRGDP and multiplied by 100.

Why do we multiply by 100? This step is not really necessary but there are two reasonably good reasons for doing so. First, nearly everyone does it (convention). Second, an index number of 100.0 for the base year suggests that the base year value is 100 percent, while in this case the 1985 value of the index number indicates that USRGDP in 1985 was 85.1 percent of the base year figure.

#### Index Number Computations

	USRGDP	INDEX
1985	6,053.7	85.1
1986	6,263.6	88.1
1987	6,475.1	91.0
1988	6,742.7	94.8
1989	6,981.4	98.2
1990	7,112.5	100.0
1991	7,100.5	99.8
1992	7,336.6	103.2

1993	7,532.7	105.9
1994	7,835.5	110.2
1995	8,031.7	112.9

You should be careful about computing year to year percent changes with index numbers. Here is how to do it correctly. Suppose we are interested in the percent change from 1994 to 1995. Compute the percent change as follows:

$$\text{Percent change from 1994 to 1995} = ((112.9 - 110.2) / 110.2) \times 100.0 = 2.45 \text{ percent.}$$

**Example 2. Computing an index number as a weighted average –the Consumer Price Index.**

The Consumer Price Index (CPI) is a commonly used measure of inflation. In the United States, the CPI is computed each month by the U.S. Department of Labor’s Bureau of Labor Statistics. You can find the CPI and other measures of inflation on the BLS website: [www.bls.gov](http://www.bls.gov)

The CPI measures the change in price of a **fixed basket** of goods and services. The basic idea is simple. Imagine yourself going to the store and buying a given basket of goods (e.g., a loaf of bread, a gallon of milk, 5 lbs of sugar, etc). Sometime later (maybe a year later) you want to know how prices have changed so you return to the store and buy the identical basket of goods. This would allow you to easily compare overall prices changes in the two years.

We will calculate a very simple CPI. Here are some prices and quantities of two goods.

	2004		2005	
	Price	Quantity	Price	Quantity
Pizza	\$10	50	\$12	52
Cola	\$2	50	\$3	\$50

$$\text{Base Year (2004) Cost of Basket} = (\$10 \times 50) + \$2 \times 50 = \$600$$

$$\text{Cost of Base Year basket in 2005} = (\$12 \times 50) + (\$3 \times 50) = \$750$$

The general formula for computing the CPI is:

$$\text{CPI} = \left( \frac{\text{Cost of Basket in the Current Year}}{\text{Cost of Basket in the Base Year}} \right) \times 100.0$$

$$\text{The CPI for 2004} = (\$600/\$600) \times 100 = 100.0$$

$$\text{The CPI for 2005} = (\$750/\$600) \times 100 = 125.0$$

Notice that the basket of goods and services is the same in both years. In other words, the quantities listed for 2005 are never used! Other examples of index numbers used by economists include the GDP Deflator, the Index of Leading Indicators, the Producer Price Index, the capacity utilization index, and various wage cost indices.

You try it. Suppose the 2006 prices and quantities are

	Price	Quantity
Pizza	14	53
Cola	2	55

If you really must know, the CPI for 2006 is 133.3.