Something Completely Different: the CPI

The *Consumer Price Index (CPI)* is a measure of the *percent change* in the price of goods and services over time. It is based on a *market basket* of goods and services that represent typical purchases of urban households.

- It is commonly used by the media and others to measure of inflation as it is felt by ordinary Americans;
- It can be used to "factor out" inflation from wages and prices, so that a wage in 1999, say, can be compared in "real dollars" to a wage in 1980;
- It is also used in legal agreements to adjust or escalate payments for changes in prices. This is done for example in
  - private sector collective bargaining agreements,
  - rental contracts,
  - insurance policies with automatic inflation protection, and
  - alimony and child support payments.

What's an "index number"?

An index number measures the percent change in the value of something.

$$\text{(index number)} = \frac{\text{(Value now)}}{\text{(Value in base period)}} \times 100$$

Example: Price of Gasoline

The price of a gallon of gasoline averaged \$0.99/gal in 1987. In 1995 it was \$1.22/gal. The gasoline price index for 1987 (1983=100) is

$$\frac{1.22}{0.99} \times 100 = 123.23$$

Note that

$$\begin{aligned} \frac{1.22}{0.99} \times 100 &= \frac{0.99}{0.99} \times 100 + \frac{0.23}{0.99} \times 100 \\ &= 100 + 23.23 \end{aligned}$$

so that *the difference from 100 is the percent change in the price.*

Example: 201 Lab Attendance Index

Here are the lab attendance figures for the semester, up through Lab 10:

Lab:	Lab1	Lab2	Lab3	Lab4	Lab5
Attendance:	138	143	140	138	130

Lab:	Lab6	Lab7	Lab8	Lab9	Lab10
Attendance:	142	138	135	120	72

Using Lab 1 as the "base period":

- The Lab Attendance Index (LAI) for Lab 2 was

$$\frac{143}{138} \times 100 = 103.62$$

  indicating an increase of 3.62% (difference from 100) over lab 1.

- The LAI for Lab 10 was

$$\frac{72}{138} \times 100 = 52.17$$

  indicating a 47.83% drop (difference from 100) in attendance from Lab 1. [This was the lab just before spring break!]

- The entire series of LAI's is:

Lab:	Lab1	Lab2	Lab3	Lab4	Lab5
LAI:	100.00	103.62	101.45	100.00	94.20

Lab:	Lab6	Lab7	Lab8	Lab9	Lab10
LAI:	102.90	100.00	97.83	86.96	52.17

The LAI's make clear where lab attendance is above or below Lab 1 (=100), and by what fraction of the Lab 1 attendance.

Note: An index's difference from 100 tells you the *percent change from the base period* but not the percent change from one period to the next.

Example: From Lab 9 to Lab 10, the LAI dropped from 86.96 to 52.17, or almost 35 points. But the relative change was

$$\frac{72}{120} \times 100 = 60$$

so the percent drop was really 40%.

Shortcut: the relative change in the index is the same as the relative change in the raw numbers:

$$\frac{52.17}{86.96} \times 100 = 60$$

Example: A Fixed Market Basket Price Index

A *fixed market basket price index* is a price index (like the gasoline index) that is based on fixed amounts of a fixed set of goods and services.
A silly example:

> A "food faddist" eats only steak, rice and ice cream. In 1990 he buys:

Item	1990 Quantity	1990 Price
Steak	200 pounds	$5.45/pound
Rice	300 pounds	0.49/pound
Ice cream	50 gallons	5.08/gallon

> After a visit from his mother he adds oranges to his diet in 1994. Oranges cost $0.56/pound in 1990. In 1994 he buys:

Item	1990 Quantity	1990 Price
Steak	175 pounds	$5.86/pound
Rice	325 pounds	0.53/pound
Ice cream	50 gallons	5.24/gallon
Oranges	100 pounds	0.66/pound

Let's calculate the "food faddist price index" (1990=100):

Item	1990 Quantity	1990 Price	1994 Price
Steak	200 pounds	$5.45/pound	$5.86/pound
Rice	300 pounds	0.49/pound	0.53/pound
Ice cream	50 gallons	5.08/gallon	5.24/pound
Total		$1,491.00	$1,593.00

The 1994 index number is then

$$1593/1491 \times 100 = 106.84$$

about a 7% increase in prices.

Notes:

- We did not change the amounts from 1990 to 1994, even though the food faddist did
- We did not change the market basket items from 1990 to 1994, even though the food faddist did.

Government index numbers are usually constructed like this: a weighted average of many quantities, with the weights and the types of quantity fixed in advance.

The Consumer Price Index is such an index number.

The Consumer Price Index (CPI)

- The CPI is a fixed market basket price index, for a market basket of about 400 items (goods and services), computed by the U.S. Bureau of Labor Statistics (BLS).
- There are many "CPI's" but the most common is CPI-U, the CPI for urban consumers.
  - The market basket items are chosen by a multistage stratified random sample of *items* to represent purchases of a typical "urban" household (defined to cover about 80% of the population).
  - The weights were determined by a multistage stratified random sample of 29,000 households who provided detailed reports on their spending in 1982–84.
  - The current prices are determined by ongoing surveys of consumers, store outlets, and items. These surveys help determine for example that paint, nails, hammers, etc. are now largely purchased at large discount stores such as Home Depot rather than at local hardware stores. These items are priced where they are purchased today, not where they were purchased in the base year.

- The CPI is a measure of inflation as it is experienced by (urban) consumers.
- The CPI is not a measure of cost of living, since it does not account for compensating behaviors that consumers use to maintain a fixed standard of living in the face of inflation, like shifting to riding the bus if driving your car gets too expensive, and so forth. Also doesn't account for taxes and investment spending.
- The CPI is generally the best measure for adjusting payments to consumers when the intent is to allow them to purchase, at today's prices, the same market basket of consumer goods and services that they could purchase in an earlier reference period. It is also the best measure to use to translate retail sales and hourly or weekly earnings into "real", "constant", or "inflation-free" dollars (all three phrases mean the same thing).
- The base period changes every 10 years or so, when major changes in the market basket items or the weights are needed.

CPI over the years (1982–84 = 100)

TABLE 6-1 Annual average Consumer Price Index, 1982–84 = 100

Year	CPI	Year	CPI	Year	CPI
1915	10.1	1970	38.8	1985	107.6
1920	20.0	1975	53.8	1986	109.6
1925	17.5	1976	56.9	1987	113.6
1930	16.7	1977	60.6	1988	118.3
1935	13.7	1978	65.2	1989	124.0
1940	14.0	1979	72.6	1990	130.7
1945	18.0	1980	82.4	1991	136.2
1950	24.1	1981	90.9	1992	140.3
1955	26.8	1982	96.5	1993	144.5
1960	29.6	1983	99.6	1994	148.2
1965	31.5	1984	103.9	1995	152.4

Source: Moore, p. 370

Examples: Adjusting for buying power

$$\begin{aligned}&\text{(Dollars at time B)}\\ &= \text{(Dollars at time A)} \times \frac{\text{(CPI at time B)}}{\text{(CPI at time A)}}\end{aligned}$$

- Joe DiMaggio is a famous baseball center fielder who recently died. In 1940 he earned an annual salary of $32,000. In 1950 his earnings were $100,000. By what percent did his real income change in that decade?

$$\begin{aligned}&\text{(1940 salary in 1950 dollars)}\\ &= \$32,000 \times \frac{24.1}{14.0} = \$55,085.71\end{aligned}$$

  so the "real" relative change was 100,000/55,085.71 = 1.82; so his income increased by about 82%.

- A newspaper article compared the local economy in 1980 and 1990. It said, "the median income for families in this county increased from $20,554 to $36,073, a 75% increase." This is misleading since the dollars are not inflation-adjusted.

$$\begin{aligned}&\text{(1990 salary in 1980 dolars)}\\ &= 36,073 \times \frac{82.4}{130.7} = \$22,742.27\end{aligned}$$

  so the real relative change was 22742.27/22554=1.008; real wages remained stagnant in that decade.

Woes of the CPI

The CPI has a major impact on government spending, because it "escalates" outlays for food stamps, Social Security, etc.

Most analysts think the CPI over-states inflation, by somewhere between 0.5% and 1.5% per year. The problem is that the fixed list of items and weights in the fixed market basket approach isn't flexible enough to accomodate changes in products and changes in buying habits.

- Changes in quality
  - BLS estimates 1993 cars cost on average $668.80 more than 1992 cars. But $310.96 is for new air bags; should not be included in price change for cars.
  - Computers and other consumer electronics
  - "New! Improved!" shampoo
  - Suppose exterior house-paint prices are up, but the new paints cover better so less paint per painted square foot is needed, and last longer so we need to buy paint less often.

- New products
  - CD's replace LP's, mono is replaced by sterieo, unleaded gas replaces leaded gas.
  - New prescription drugs
  - Suppose exterior house-paint prices are up, but consumers have switched from oil-based pains to latex water-based paints, a different product.
- Changing buying habits
  - Suppose exterior house-paint prices are up, but buyers have switched from small hardware stores to Home Depot and its clones, so the price actually paid is not up as much as the hardware store prices.

BLS works very hard to keep up with these changes. Good decisions take time $\Rightarrow$ BLS is always behind. So CPI is a little too high (0.5% to 1.5%).

Sometimes adjustments beyond what the BLS recommends are made. These adjustments can be political (budget balancers vs. social security constituents, e.g.)

Government Statistics

Economic and census data

- monthly CPI, monthly unemployment rate, other statistics. Current Population Survey (60,000 households).
- Personal incomes, stock market fluctuations, outcomes of presidential elections

Challenges of US Statistical Agencies

- Underfunding

  US statistical agencies have a good reputation for accuracy and for publishing information quickly. But…

  - Expensive to keep up with changes in economy
  - Expensive to attempt and exhaustive census
  - Hard to attract quality economists and statisticians (salary)
  - Could it be farmed out? Freedom of information vs. market solutions; other policy considerations?

- Fragmentation
  - Some countries like Canada have a single independent government agency (Statistics Canada) that oversees all statistical operations in the country.
  - Others attach a few smaller statistical organizations to various branches of government
  - The United States has 72 federal statistical offices, with weak coordination between them.
    - Census Bureau (Dept of Commerce); Bureau of Labor Statistics (Dept of Labor) are the most prominent. Bureau of Economic Analysis; National Center for Health Statistics; National Center for Education Statistics; Bureau of Justice Statistics; etc.
    - Good at resisting direct political influence, but indirect (competing for funding) can't always be ruled out.
    - Relatively little coordination between the various statistical offices.

Social data

Economic data are published month by month, with large samples, since their role in helping to guide economic policy is clear.

Social data, on education, health, housing, crime, help us to understand our society and address its problems, but are not needed for short-term manangement.

- Government not very good at social surveys.
  - Invasiveness; tend to ask "objective" questions.
  - Greater political pressure, especially on hot-button issues.
  - People are often hesitant to respond in a government-run survey.
- Government "farms out" social surveys
  - E.g. National Opinion Research Center (NORC), at U of Chicago.
  - General Social Survey (1500 people).