Chapter 4

Inflation

Our everyday experience tells us that pretty much everything costs more each year than the year before. That’s known as inflation. A dollar today is somehow not the same as a dollar last year. Common sense says it’s important to understand that quantitatively in order to understand changes in your salary, the prices you pay and the value of what you own. In this chapter we explore inflation in some familiar contexts. We mine the internet for data about inflation and use the 1+ technique from Chapter 3 to unravel its subtleties.

Chapter goals:

Goal 4.1. Use an online inflation calculator.

Goal 4.2. Adjust prices for the effect of inflation.

Goal 4.3. Understand the Consumer Price Index.

Goal 4.4. Understand the historic value of money, using the terms current dollars and constant dollars.

Goal 4.5. Reinforce techniques for dealing with percentage changes. Understand the effective change of a price over time.

4.1 Red Sox ticket prices

In Section 3.2 we studied the increase in Red Sox ticket prices from 2003 to 2008 illustrated in Figure 3.1. We found that ordinary ticket prices seemed to have grown by a staggering 23% from $42.26 to $52.16.

To understand what that increase means, we need to take inflation into account. How does the 23% increase in the Red Sox ticket price compare to the average increase of pretty much everything from 2003 to 2008?

Fortunately, the federal Bureau of Labor Statistics provides an Inflation Calculator on line at http://www.bls.gov/data/inflation_calculator.htm that you can use to do just that. The screen shot in Figure 4.1 shows that you’d need $49.45 in 2008 to buy what cost $42.26 in 2003. That means ordinary ticket prices at Fenway Park increased by $52.16 − $49.45 = $2.71 when measured in “2008 dollars”. The relative change was $52.16/$49.45 = 1.05480283, an increase of just over 5% – a lot less than 23%.

The $275 you paid for a premium seat in 2003 would be worth $321.78 in 2008, so, adjusting for inflation, the price increased by just $325 − $321.78 = $2.22. The relative change was $325/$321.78 = 1.01, an increase of just one percent.
4.2. **INFLATION IS A RATE**

This calculation shows that the change in Red Sox Ticket prices just about matched the *average* price increase for everything. But that’s just an average.

Some costs increase faster than the average inflation rate. For example, health care spending per person increased by 4.6\% from 2010 to 2011 according to a report issued by the Health Care Cost Institute.\(^1\) Since the inflation rate from 2010 to 2011 was 3.16\%, health care costs increased faster than inflation.

College tuition also tends to increase faster than the inflation rate. The College Board reported that published tuition and fees at public four-year colleges and universities increased by 4.8\% from 2011-2012 to 2012-2013. Tuition and fees at private four-year colleges increased by 4.2\%. Both these rates exceed the inflation rate of just under 2.1\% for that year.

The good news is that even though these rates are above inflation, they are smaller than previous increases. The report notes that “average published tuition and fees at public four-year colleges and universities increased by 31\% beyond the rate of inflation over the five years from 2002-03 to 2007-08, and by another 27\% between 2007-08 and 2012-13.”\(^2\)

Read the previous statement carefully. The five year inflation rates for those two five year periods were 15.3\% and 10.7\% respectively. The percentage increase in tuition and fees was *in addition* to the inflationary increase in each case.\(^3\)\(^4\)

### 4.2 Inflation is a rate

The inflation calculator says you would have to pay $102.85 in 2007 for stuff that cost $100 in 2006.\(^5\)

There are several ways to think about the increase from $100 to $102.85. The absolute change is $2.85. But...
4.2. Inflation is a rate

the relative change is more informative and more traditional:

\[
\frac{\$102.85}{\$100} = 1.0285,
\]

which we recognize as an increase of 2.85% – the annual inflation rate.

Inflation means the “value of a dollar” changes from year to year. That’s often confusing. Sometimes it helps to think of adjusting for inflation as currency conversion. To make that point clearer, suppose year old 2006 dollar bills have faded to yellow, while 2007 dollars were the usual green. The conversion rate is

\[
\frac{\text{green dollars}}{\text{yellow dollar}} = \frac{2007 \text{ dollars}}{2006 \text{ dollar}} = 1.0285
\]

or

\[
\frac{\text{yellow dollars}}{\text{green dollar}} = \frac{2006 \text{ dollars}}{2007 \text{ dollar}} = 0.9723
\]

Yellow dollars are worth more than green dollars.

What would be the cost in 2007 of an item that cost $10,000 in 2006? You can enter 10,000 in the inflation calculator, or you can use the fact that you already know the inflation rate is 2.85%. In one step with the 1+ trick you discover that

\[
1.0285 \times \$10,000 = \$10,285.
\]

If you ask the inflation calculator to do the work it tells you the answer is $10,284.82. That’s essentially the same 2.85% inflation rate. The pennies add too much precision to the approximate answer.

The 1+ trick lets us combine inflation rates over two years. The inflation rate from 2006 to 2007 was 2.85%. The inflation calculator tells us that the inflation rate from 2007 to 2008 was 3.84%. It’s tempting to guess that the inflation rate from 2005 to 2007 was 2.85% + 3.84% = 6.69% but we know better. The inflation computation from 2007 to 2008 should start with the already inflated prices from 2007. Here’s how to work out the right answer using the trick:

\[
1.0285 \times 1.0384 = 1.0679944 \approx 1.0680.
\]

Then read off the combined inflation rate as 6.80% by subtracting the 1.

If you’re still uncomfortable with the 1+ trick, check the answer the old fashioned way. Stuff that cost $100 in 2006 would cost $100 \times 1.0285 = $102.85 in 2007. That stuff would cost $102.85 \times 1.0384 = $106.79944 \approx $106.80 in 2008: an inflation rate of 6.80%. \[6\]

The inflation calculator confirms our analysis.

The moral of the story:\[7\]

Don’t add percentages. Use the 1+ trick to combine them with a single multiplication.

---

\[6\] The trailing zero in 6.80 doesn’t change the value of the number. Writing 6.8 might seem to be just as good. But that zero at the end does matter. It tells you how precise the figure is. 6.8 could be anything between 6.75 and 6.85, while 6.80 must be between 6.795 and 6.805. In this example we want the second decimal place in the answer since there were two decimal places of precision in the data we started with. So don’t throw away trailing zeroes.

\[7\] You’ve seen this before, in Chapter 3.
4.3  More than 100%

The inflation calculator’s default starting year (what you see when you first visit the page) is 1980. Using that starting year we see that you would pay about $262 in 2009 for stuff that cost $100 back in 1980. That means that prices (on average) have increased by a factor of

\[
\frac{262}{100} = 2.62.
\]

They are more than two and a half times what they were. To use the 1+ trick to express the increase as a percentage we have to find the missing “1” that represents the whole:

\[
2009 \text{ cost} = 2.62 \times (1980 \text{ cost}) = (1 + 1.62) \times (1980 \text{ cost}) = 1980 \text{ cost} + 1.62 \times (1980 \text{ cost})
\]

so the percentage change in the 29 year time period is 162%. In the 2.62 there was no visible “1” to ignore. What we need to do is to subtract the 1 from the 2.62. That 1 represents 100% of the 1980 value of the dollar and we are interested in just the percentage increase. Another way of saying this: the inflation rate from 1980 to 2009 is 162%.

Here’s another example showing how “adjusting for inflation” changes the impression numbers create.

On Sunday, June 19, 2011 The Boston Globe reported that “The United States spends around $30 billion a year on the National Institutes of Health” and later in the article that “NIH funding in 1939 totaled less than $500,000 a year, a sum that supported just one institute. Adjusting for inflation, the budget has since increased nearly 4,000-fold.”

The numbers seem to say that the NIH budget was \((\frac{30 \text{ billion}}{500,000}) = 60,000\) times as large in 2011 as it was in 1939. But that’s not right once you adjust for inflation. Let’s check that the author did that correctly. The inflation calculator shows that you’d need just over $8 million in 2011 to buy what cost $500,000 in 1939. Therefore the actual purchasing power of NIH budget grew by a factor of about \((\frac{30 \text{ billion}}{8 \text{ million}}) = 3,750\). That’s the same order of magnitude as the “nearly 4,000” in the article. It’s a lot, but a lot less than 60,000 times as much.

When the change is this large it’s better to say “4,000 times as much” than “3,999 percent bigger” or even (rounded correctly) “4,000 percent bigger.”

4.4  The consumer price index

The Bureau of Labor Statistics inflation calculator lets you compare prices between any pair of years. The Consumer Price Index is a single number that captures the same information in a different way.

The Consumer Price Index (CPI-U) is compiled by the Bureau of Labor Statistics and is based upon a 1982 Base of 100. A Consumer Price Index of 158 indicates 58% inflation since 1982.

When we check that with the calculator by asking it for the cost in 2009 dollars for what $100 would buy in the base year 1982 we find the answer $222.32 instead. The numbers don’t match exactly because the one in the table is computed not with a base year of 1982 but with a base year that’s the average of 1982, 1983 and 1984. \[10\]

To find the inflation rate between two years when you know the CPI for each, the ratio does the job. For example, the 2007 CPI was 207.342. Then

\[
\frac{2009\text{ CPI}}{2007\text{ CPI}} = \frac{214.537}{207.342} = 1.0347111 \approx 1.035
\]

tells us that the inflation rate from 2007 to 2009 was three and a half percent. In other words, the percentage change in the Consumer Price Index is just the inflation rate.

### 4.5 How much is your raise worth?

Suppose your salary in 2006 was $40,000 and your contract stated that you would receive a cost of living raise equal to the inflation rate. From 2006 to 2007, the inflation rate was 2.85%, so your 2007 salary would be

1.0285 \times $40,000 = $41,140.

Your salary has increased – you see it in your paycheck each month. But you’re not really any better off. Because of the inflation, you would need all of the $41,140 in 2007 to buy the same things you bought in 2006, when your salary was $40,000. Since your raise is equal to the inflation rate, your buying power has not changed at all. Effectively, your salary has not increased.

Of course you were clever enough to know this, so you negotiated a 5% raise from 2006 to 2007 so that you would actually be earning more after taking inflation into account. With that raise your 2007 salary would be $42,000.\[11\] How much has your buying power increased? The inflation rate was 2.85%, so the difference predicts an increase of 5% – 2.85% = 2.15%. But you should be suspicious. Subtracting percentages is as unreliable as adding them.

To find the actual change in your buying power you should find the buying power of your 5% higher 2007 salary in 2006 dollars, by undoing the inflation. That requires division:

\[
\frac{1.05}{1.0285} = 1.02090423 \approx 1.021.
\]

That is, your buying power has increased only by 2.1%. The subtraction estimate was 2.15% – not too far off since the actual percentages involved are small.

This method is pretty subtle (though you should be getting used to it by now). We can check the answer the old fashioned way. Remember that we just figured out that you would need $41,140 in 2007 to maintain the buying power you had in 2006. To see how your buying power has effectively changed, calculate the relative change:

\[
relative\ change = \frac{\text{new value} - \text{reference value}}{\text{reference value}} = \frac{42,000 - 41,140}{41,140} = 0.0209042295 \approx 0.021.
\]

\[10\] See comment in instructor’s manual.

\[11\] You don’t need a calculator for that arithmetic. 10% of 40 is 4, so 5% is 2, so your new salary will be 40+2 = 42 thousand dollars.
4.6. THE MINIMUM WAGE

That’s a 2.1% increase.

So things aren’t always what they seem. We’ll close this section by returning to the information at the end Section 4.1 on the increase in college costs from 2002-03 to 2007-08. The visible change was 31% beyond the rate of inflation. The inflation rate for that period was 15.3%. To find the actual rate of increase in dollars we need our friend the 1+ trick:

\[
1 + \text{actual rate of increase} = (1 + \text{inflation rate})(1 + \text{rate above inflation})
\]

\[
= (1.153)(1.31)
\]

\[
= 1.51043,
\]

or more than 50%. That’s a larger number than you get by simply (and incorrectly) adding the 15.3 and 31 percent increases.

4.6 The minimum wage

The federal minimum wage is the legal minimum employers must offer workers paid by the hour. In 1991, the federal minimum wage was $4.25 per hour. The table below shows its value at each increase since it was first set in 1938. Note that it changed only twice between 1991 and July 2007, when it increased to $5.85 per hour. If we take inflation into account we see that this was not an effective increase at all. In 2007, you would need $6.50 to buy what you could get for the $4.25 you earned in an hour in 1991. Since the minimum wage increased only to $5.85, employees earning the minimum wage were better off in 1991 than they were in 2007. Figure 4.2 traces the history of the minimum wage in real (2010) dollars using the data in Table 4.3. Note the jumps in the real value in the years when congress passes an increase, followed by gradual decline as inflation eats away at the gain.

![Figure 4.2: The minimum wage, in nominal and real (2010) dollars](http://oregonstate.edu/instruct/anth484/minwage.html)

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12 This data does not come from an official government web page, although its name suggests that. It’s from the commercial site [http://www.about.com/](http://www.about.com/)—probably reliable, but you should ask yourself the question.
### Table 4.3: Federal Hourly Minimum Wage History

<table>
<thead>
<tr>
<th>Month / Year</th>
<th>Minimum Hourly Wage</th>
<th>Month / Year</th>
<th>Minimum Hourly Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 1938</td>
<td>$0.25</td>
<td>January 1978</td>
<td>$2.65</td>
</tr>
<tr>
<td>October 1939</td>
<td>$0.30</td>
<td>January 1979</td>
<td>$2.90</td>
</tr>
<tr>
<td>October 1945</td>
<td>$0.40</td>
<td>January 1980</td>
<td>$3.10</td>
</tr>
<tr>
<td>January 1950</td>
<td>$0.75</td>
<td>January 1981</td>
<td>$3.35</td>
</tr>
<tr>
<td>March 1956</td>
<td>$1.00</td>
<td>April 1990</td>
<td>$3.80</td>
</tr>
<tr>
<td>September 1961</td>
<td>$1.15</td>
<td>April 1991</td>
<td>$4.25</td>
</tr>
<tr>
<td>September 1963</td>
<td>$1.25</td>
<td>October 1996</td>
<td>$4.75</td>
</tr>
<tr>
<td>February 1967</td>
<td>$1.40</td>
<td>September 1997</td>
<td>$5.15</td>
</tr>
<tr>
<td>February 1968</td>
<td>$1.60</td>
<td>July, 2007</td>
<td>$5.85</td>
</tr>
<tr>
<td>May 1974</td>
<td>$2.00</td>
<td>July, 2008</td>
<td>$6.55</td>
</tr>
<tr>
<td>January 1975</td>
<td>$2.10</td>
<td>July, 2009</td>
<td>$7.25</td>
</tr>
<tr>
<td>January 1976</td>
<td>$2.30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 4.7 Exercises

**Exercise 4.7.1.** [S][R][W][Section 4.1][Goal 4.1] Inflation calculator practice

Use the inflation calculator to find the inflation rate (as a percent) from 2003 to 2007, using purchase amounts of $1, $100 and $10,000. Explain why the answers differ. Which number is the most appropriate?

**Exercise 4.7.2.** [U] Running to keep up with inflation

Use the data in Exercise 3.10.2 (page 71) to compare the growth in the number of finishers in the New York marathon to the inflation rate for the corresponding years.

**Exercise 4.7.3.** [S][Section 4.1][Goal 4.1][Goal 4.2] For Sale: A $160,000 Apple Computer

The Apple-1 computer was built and sold by Steve Jobs and Steve Wozniak, Apple’s co-founders, in 1976 for $666.66 – the strange price was put into effect because Mr. Wozniak liked repetitive numbers. (An inflation calculator determines that price is equivalent to $2560 in today’s dollars.) It’s estimated that only 200 of these computers were produced and sold before Apple moved onto the next model, the Apple II.

(a) The article was written in 2010. Check the inflation calculation used in this article.

(b) Later on the article says that the computer is expected to sell for $160,000 at auction. Is the expected auction price a bargain?

(c) What did the computer actually sell for at that auction?

(d) (Optional) Why is 666 called “the number of the beast”?

**Exercise 4.7.4.** [S][Section 4.4][Goal 4.1][Goal 4.2] CPI fails to reflect retirees’ inflation

An article in The Baltimore Sun on January 15, 2008 with that headline included an interview with a retiree who complained about high prices.

Fill up your gas tank or buy a gallon of milk, and you can’t help but think that the inflation rate that comes out each month doesn’t reflect the pounding your wallet is taking.

That’s Lois’ complaint. The Baltimore County retiree’s pension and Social Security benefits are pegged to the Consumer Price Index. This year, for instance, her Social Security benefits will go up 2.3 percent. Yet the price of one of her prescription drugs has shot up 50 percent in the past five months.

“Every time I buy milk, it’s gone up. Bread is almost $3 for a loaf. I can remember it being 10 or 15 cents,” the 72-year old says.

(a) Use the inflation calculator to estimate when bread would have been that inexpensive.

(b) What’s wrong with the reasoning in this excerpt from the article?

Exercise 4.7.5. [S][Section 4.1] [Goal 4.1] [Goal 4.2] Good to the last penny.

On the Commonwealth of Massachusetts web page at [http://www.sec.state.ma.us/trs/trsbok/mod.htm](http://www.sec.state.ma.us/trs/trsbok/mod.htm) you can read that

The Massachusetts State House cornerstone was laid on the Fourth of July, 1795, by Governor Sam Adams and Paul Revere, Grand Master of the Masons. The stone was drawn by fifteen white horses, one for each of the states of the Union at that time. The cost of the original building? $133,333.33

... Paul Revere & Sons coppered the dome in 1802 to prevent water leakage. Some seventy years later the dome was gilded with 23 carat gold leaf for the first time. The cost was $2862.50; the most recent gilding, in 1997, cost $300,000.

(a) What’s strange about the number $133,333.33 for the original cost of the State House? How do you think the person who wrote these paragraphs came up with that number?

(b) Adjust the three dollar amounts in this quotation to take inflation into account. Have building and gilding gotten more or less expensive over the years?

[See the back of the book for a hint.]

Exercise 4.7.6. [S][Section 4.1] [Goal 4.1] Several ways to skin a cat

Find another inflation calculator on the internet and compare it to the one provided by the government. Do they give the same answers? If not, why not? Do they cover the same range of years? Are they equally easy to use? Make sure you give a clear citation for the calculator you find.

If it’s easy for you, make screen shots comparing your inflation calculator to the one at the Bureau of Labor Statistics.

Exercise 4.7.7. [S][Section 4.1] [Goal 4.1] [Goal 4.2] When was a dime a nickel?

On December 29, 2011 Chris Lohmann wrote in a letter to *The Boston Globe*
Let’s not forget that a dime now is worth less than a nickel was when the original bottle bill was passed.

(a) Use the inflation calculator to estimate when the Massachusetts law calling for a nickel bottle deposit was passed.

(b) If you can, check your estimate by finding the actual year.

[See the back of the book for a hint.]

Exercise 4.7.8. [S] [R] [Section 4.2] [Goal 4.1] [Goal 4.5] Twenty years as two decades.

(a) Use the inflation rate calculator to find the inflation rate (as a percent) from 1990 to 2000, from 2000 to 2010 and from 1990 to 2010.

(b) Explain why the inflation rate from 1990 to 2010 is not just the sum of the rate from 1990 to 2000 and the rate from 2000 to 2010.

(c) Use the $1+$ trick to compute the 1990 to 2010 rate correctly from the rates for the two previous decades.

Exercise 4.7.9. [S] [Section 4.2] [Goal 4.1] [Goal 4.4] Piecework

In the 1880s many young women in large cities worked at home sewing clothing. They were paid by the piece, hence the name “piecework” for this type of labor. A pants stitcher would finish a pair of pants, putting in canvas for the pockets and waistband linings, and would receive 12.5 cents per pair of pants finished. She could generally finish 16 pairs of pants a week, working from 8 AM until dark.

(a) What was her hourly rate of pay in 1880?

(b) Convert her 1880 wages to current wages.

(c) Compare her hourly rate to the current minimum wage.

Exercise 4.7.10. [S] [Section 4.2] [Goal 4.1] [Goal 4.4] [Goal 4.2] [Goal 4.5] Hollywood Math: Bad to Worse

A short article in the January 10, 2011 edition of The New York Times discussed the amount spent on DVDs over the past six years. The article begins:

Probably the best thing about last week’s dreary annual summary of home entertainment revenue from the Digital Entertainment Group is that the numbers weren’t adjusted for inflation. That made the six-year tumble in cumulative spending on DVDs and other forms of home entertainment look only about half as bad as it really was.

In the peak year of 2004, . . . consumers spent about $21.8 billion to rent and buy DVDs, Blu-ray discs, digital downloads and other forms of home entertainment.

Under pressure from piracy, competing entertainment and economic weakness, the number has fallen every year since, for a total drop of about 13.8 percent, to $18.8 billion in 2010.

Unless, of course, you adjust to reflect the erosion in buying power of the dollar over the last six years. Plug the same $21.8 billion into an inflation calculator from the Bureau of Labor

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16 http://www.bostonglobe.com/opinion/letters/2011/12/29/raise-bottle-deposit-cents/0x0nLO7DKi10wE69Ru5GiN/story.html
17 You can read more about this on the web at http://historymatters.gmu.edu/d/5753/
Statistics – a reality check that fantasy-minded Hollywood would love to avoid – and you find that it would take about $25.3 billion in current dollars to match that figure today.  

(a) Verify the “reality check” using the BLS inflation calculator.

(b) If we adjust for inflation, how dramatic is the drop in spending over the six year period?

(c) Explain how not adjusting for inflation makes the drop in spending look “only about half as bad as it really was,” as the article notes in the first paragraph.

(d) The article also noted that box office revenues rose from $9.3 billion in 2004 to $10.6 billion in 2010. Calculate the percentage increase in box office revenues, then re-calculate the percentage increase using inflation-adjusted dollars. Have box office revenues increased or decreased over this six-year time period?

Exercise 4.7.11. [S][Section 4.2][Goal 4.1][Goal 4.5] Deflation

What was the inflation rate from 2008 to 2009? [See the back of the book for a hint.]

Exercise 4.7.12. [S][Section 4.2][Goal 4.1][Goal 4.2][Goal 4.5] Holiday Pops

Adjust the calculations in Exercise 3.10.58 (page 91) to take into account inflation from 2009 to 2012.

Exercise 4.7.13. [S][Section 4.2][Goal 4.1][Goal 4.2][Goal 4.5] The Jollity Building

A. J. Liebling wrote that

[Mr. Ormont] now gets fifty dollars a week and 2 percent of the total rents, which adds about two thousand a year to his income.  

(a) What was the average weekly rent on which Mr. Ormont’s commission was based?

(b) The article appeared in 1941. What would Mr. Ormont’s annual income be today, adjusted for inflation?

(c) Mr. Ormont managed the Jollity Building, a rather seedy low class establishment for “the petty nomads of Broadway – chiefly orchestra leaders, theatrical agents, bookmakers, and miscellaneous promoters.” Was he reasonably well paid for this job?

(d) Sometimes we find quantitative reasoning questions in our casual reading (not the daily paper). This one comes from a reprint of The Jollity Building in Just Enough Liebling, a collection of the author’s New Yorker pieces, where it was dated 1938. Redo the previous questions with this date. How much of a difference does the three years make?

Exercise 4.7.14. [S][C][Section 4.2][Goal 4.2][Goal 4.5] Firefighters’ pay.

On June 10, 2010 The Boston Globe reported that in the five years between 2006 and 2011 Boston firefighters received raises of 2%, 2.5%, 3%, 3.5%, 2.5% and 1.5%.

(a) Explain why the overall raise for this five year period is not just the sum of the six percentage increases.

\[\text{The Jollity Building, The New Yorker, April 26, 1941}\]
\[\text{North Point Press, New York, 2004.}\]
4.7. EXERCISES

(b) What was the firefighters’ overall raise for the five year period?
(c) What was the firefighters’ overall raise when you take inflation into account?

[See the back of the book for a hint.]

Exercise 4.7.15. [U][Section 4.2] [Goal 4.2] Charging for Debit Cards Is Robbery


Debit cards were developed by banks as a replacement for paper checks. When a consumer pays with a debit card instead of a check, the bank saves money. In the 1980s, Visa calculated the savings at 55 cents to $1.60 per check. The savings is much higher today. \(^21\)

(a) If we assume that the cost of processing checks has grown with inflation we should calculate the cost “55 cents to $1.60 . . . [in] the 1980s” in 2011 dollars. Do that.
(b) Estimate the number of debit card transactions per day in the United States.
(c) How much do banks earn on debit card transactions because they save the cost of processing checks?
(d) How should the “$6.6 billion cost” in Exercise 3.10.36 (page 82) be revised to take into account your answer to the previous part of this exercise?

Exercise 4.7.16. [U][Section 4.2] [Goal 4.2] [Goal 4.5] Middle income family spends $235,000 to raise baby.

On June 23, 2012, you could read on the Dallas Morning News website that

[In 1960] the cost of raising a child was just over $25,000 for middle-income families. That would be $191,720 today when adjusted for inflation. \(^22\)

(a) Check the inflation calculation in the text.
(b) Has the cost of raising a child increased faster or slower than inflation?

[See the back of the book for a hint.]

Exercise 4.7.17. [S][Section 4.2] [Goal 4.2] [Goal 4.5] A raise tied to the inflation rate.

Consider these two different ways to calculate a raise that’s “10% over the rate of inflation”:

(a) What is your new salary if you add the inflation rate to your 10% raise and and use that as your percentage raise?
(b) What will you earn if you first compute your 10% increase and then increase that to take inflation into account?
(c) Which is the best approach (for you - since it’s your salary)?

\(^21\) www.nytimes.com/2011/10/07/opinion/debit-card-fees-are-robbery.html
4.7. EXERCISES

[See the back of the book for a hint.]

**Exercise 4.7.18.** [U][S][R][Section 4.5] [Goal 4.2] [Goal 4.5] Committee approves 1 percent pay raise . . .

On June 26, 2013, the Madison, Wisconsin *Star Tribune* reported that

> Most Wisconsin state workers and employees at the University of Wisconsin system will receive a 1 percent pay raise starting Sunday, . . .
>
> The pay raise is the first for UW workers and non-union covered employees since 2008.
>
> “One percent doesn’t even hold the workers even,” said Marty Bell, executive director of the Wisconsin State Employees Union.

(a) What is the effective raise for UW workers and non-union covered employees?

(b) The reporter noted that the cost for paying the salary increases for University of Wisconsin faculty would be $52.4 million over two years. What is the total salary pool of these employees (before the raises)?

**Exercise 4.7.19.** [U][R][Section 4.5] [Goal 4.2] [Goal 4.5] When is a raise not a raise?

Your employment contract calls for a 3% annual raise. If the inflation rate is 4.2%, what is your effective “raise”?

**Exercise 4.7.20.** [S][R][Section 4.5] [Goal 4.1] [Goal 4.2] [Goal 4.4] Private colleges vastly outspent public peers

The Fort Wayne, IN *Journal Gazette* reported on July 10, 2010 that

> Private institutions, on average, laid out $19,520 per student for instruction [in 2007-2008], a 22 percent increase from a decade earlier, the Delta Project on Postsecondary Education Costs, Productivity, and Accountability, a Washington-based nonprofit research group, said Friday.
>
> Public universities spent $9,732 for each student, up 10 percent in the decade, according to the report.

(a) Calculate these increases in spending when inflation is taken into account.

**Exercise 4.7.21.** [U][Section 4.5] [Goal 4.1] [Goal 4.2] [Goal 4.4] *DPS, teachers’ union reach accord*

EdNews Colorado reported on June 19, 2010 that

> Teachers in Denver Public Schools would receive their first cost-of-living increase in years under a tentative agreement between the district and union announced Tuesday.
>
> It also follows three years of cost-of-living pay freezes.
>
> Under the terms of the tentative agreement, Denver teachers would receive their scheduled increases for additional experience and education. They also would receive a 1 percent cost-of-living raise if a proposed $49 million tax increase for operating dollars is placed on the November ballot and approved by voters. . . . In addition, if the increase passes, teachers would receive a .5 percent raise in 2013-14 and a .5 percent raise in 2014-15.

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24 [http://www.journalgazette.net/article/20100710/NEWS/307109943/-1/NEWS09](http://www.journalgazette.net/article/20100710/NEWS/307109943/-1/NEWS09)
(a) Assuming all of the increases pass, what is the total cost of living increase that a teacher would receive by the end of the 2015 school year?

(b) If a teacher did not receive any merit increases over the past three years (some did not), what is the effective percentage decrease in that teacher’s salary during this time period?

**Exercise 4.7.22.** [U][S]Section 4.3 [Goal 4.1] [Goal 4.2] **REPORT: County wages dropped nearly 14 percent in last decade**

On June 6, 2012 the Oregon *The Portland Tribune* published a brief article with this headline. The article said:

Over the last decade, inflation-adjusted wages in Columbia County dropped 13.8 percent, while salaries in nearby Oregon counties grew or remained mostly static. A report released June 1 by the Oregon Employment Department and the Bureau of Economic Analysis shows between 2000 and 2011, the average wages for . . . jobs in Columbia County rose by 13 percent. But county wages actually decreased 13.8 percent during that time when inflation is taken into account.

In neighboring Clatsop County, . . . (t)he inflation adjusted wages . . . rose 0.4 percent from 2000 to 2011.  

(a) Use the CPI inflation calculator to make sense of the numbers for workers in Columbia County.

(b) What was the average increase (without taking inflation into account) from 2000 to 2011 for workers in Clatsop County?

**Exercise 4.7.23.** [S][U]Section 4.3 [Goal 4.1] [Goal 4.2] [Goal 4.4] **Newspaper sales slid to 1984 levels in 2011**

A post to the blog “Reflections of a newsosaur” reported on March 15, 2012 that

In the poorest showing since 1984, advertising revenues at newspapers last year fell 7.3% to $23.9 billion, according to figures quietly published Wednesday by the Newspaper Association of America.

. . .

The combined print and digital sales reported by the trade association for last year are less than half of the all-time sales peak of $49.4 billion achieved as recently as 2005.

. . .

The last time sales were this low was 1984, when they totaled $23.5 billion. Adjusted for inflation, the 1984 sum would be worth nearly $50 billion today.  

(a) Use the CPI calculator to verify the claim in the third paragraph.

(b) A comment to the blog post stated, “Shouldn’t the headline be ‘Newspaper sales slid to half of 1984 level in 2011?’ The comparison seems meaningless when not adjusted for inflation.” Do you agree? Explain your answer.

(c) The claim in the second paragraph has *not* been adjusted for inflation. Would the statement change if you adjusted that figure for inflation?
4.7. EXERCISES

(d) The blog Carpe Diem gave updated information on newspaper revenues in a post on September 6, 2012. In that post, the author predicted that print newspaper advertising will be lower in 2012 than in 1950, when adjusted for inflation. In fact total advertising in 2012 was $22.3 million. In 1950, total advertising was $2.07 million (in 1950 dollars). Use the CPI calculator to see if he was right.

Exercise 4.7.24. [S][R][Section 4.5] [Goal 4.1] [Goal 4.2] [Goal 4.4] The MAA

Annual dues for the Mathematical Association of America were $3 in 1916. They were $192 in 2011.

(a) How much would the $3 dues in 1916 be in 2011 dollars?

(b) How much have dues gone up (or down) between 1916 and 2011, in 2011 dollars, in absolute and relative terms?

Exercise 4.7.25. [R][S][Section 4.6] [Goal 4.1] [Goal 4.4] [Goal 4.5] Working for the minimum wage

(a) Figure out the annual income in 2007 dollars for someone who worked at a minimum wage job 40 hours/week for 50 weeks in 1975.

(b) Compare that income to the annual income of someone working the same amount at the minimum wage in 2007.

You’ll have to look up the minimum wage for each year – or look back in this chapter to find that information.

Exercise 4.7.26. [N][G][Section 4.6] [Goal 4.2] [Goal 1.1] [Goal 1.2] ECONOMISTS IN SUPPORT OF A $10.50 U.S. MINIMUM WAGE

At http://www.peri.umass.edu/fileadmin/pdf/resources/Minimum_Wage_petition_website.pdf you can read a July 2013 open letter from dozens of economists advocating an increase in the federal minimum wage. (There’s a local copy at http://www.cs.umb.edu/~eb/qrbook/Inflation/EconomistsMinimumWagePetition.pdf.)

The essay suggests lots of good quantitative reasoning questions: check their arithmetic, verify their estimates, put their conclusions in a personal context, . . .

Here’s one particularly interesting paragraph.

On average, even fast food restaurants, which employ a disproportionate share of minimum wage workers, are likely to see their overall business costs increase by only about 2.7 percent from a rise today to a $10.50 federal minimum wage. That means, for example, that McDonalds could cover fully half of the cost increase by raising the price of a Big Mac, on average, from $4.00 to $4.05.

Exercise 4.7.27. [S][Section 4.6] [Goal 4.2] [Goal 4.4] Penny Dreadful

On page 60 of the March 31, 2008 issue of The New Yorker David Owen writes

Breaking stride to pick up a penny, if it takes more than 6.15 seconds, pays less than the federal minimum wage.

http://mjperry.blogspot.com/2012/09/freefall-adjusted-for-inflation-print.html

See comment in instructor’s manual.
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(a) What minimum wage was the author assuming when he wrote this? Use this data to estimate your answer.

(b) Check Owens' arithmetic by comparing your answer to the actual federal minimum wage at that time.

(c) (Optional) Find and read Owens' article. It has lots of interesting things to say about coins, and quantitative reasoning.

(d) (Optional) What is the origin of the phrase “Penny Dreadful”?


(a) Suppose the annual inflation rate was 3\% for 10 years in a row. What was the inflation rate for the decade?

(b) Find the inflation rate for the decade for the decade from 1960 to 1970. If the inflation rate had been the same for each year in that decade, what would it have been?

[See the back of the book for a hint.]

Review exercises

Sample routine review questions. When *Common Sense Mathematics* is published these and others may be available in an online homework system/

Exercise 4.7.29. [A] For each of the following, use the online CPI Inflation Calculator

(a) Find the buying power in 2010 of $12.50 in 2004.

(b) Find the buying power in 2011 of $42.99 in 2000.

(c) Find the buying power in 2008 of $20.00 in 2010.

(d) Find the buying power in 2010 of $100 in 1992.

Exercise 4.7.30. [A] Rewrite each sentence, expressing the change as a percentage.

(a) The cost of gasoline doubled during this time period.

(b) The value of the painting tripled over the past decade.

(c) The price of milk is two-thirds of what it cost last year.

(d) The CEO’s salary is ten times the salary of the lowest-paid worker in the company.

(e) I cut my bills by a third last year.

(f) His salary is one and a half times more than her salary.

(g) Our budget this year is half of what it was last year.