



Data LITERACY

Keeping It Real: Teach ACRL Information Literacy Frames with FRED® Data

Standards and Benchmarks (see page 13)

Lesson Description

In this activity, students first learn about the concepts of nominal values, real values, and inflation. Next, they learn about basic strategies for establishing the reliability of a data source. Students work in FRED® and use the formula $\text{real} = (\text{nominal}/\text{CPI}) * 100$ to plot inflation-adjusted minimum wage rates for two states and then compare the results. Students discuss the new information produced as a result of their work.

Objectives

Students will be able to

- create new FRED® graphs;
 - define minimum wage, nominal and real wages, and consumer price index (CPI);
 - identify metadata in a FRED® graph;
 - identify additional questions for further research;
 - describe the difference between data sources and aggregators;
 - describe the difference between nominal and real wages; and
 - understand the issues of authority regarding trustworthiness, reliability, and credibility of data sources.
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Compelling Question

How can you determine the purchasing power of wages and earnings over time?

Time Required

45 minutes

Materials

- Handout 1, one printed copy per student/group or one digital copy
- Handout 2, one printed copy per student/group or one digital copy
- Internet access
- Projector for the instructor
- At least one computer (preferably more) per student group. If working individually, each student will need a computer

Preparation

- Make sure you are comfortable navigating around FRED®, finding values for data series used in this lesson, and identifying data sources. A demonstration is located at <https://fredhelp.stlouisfed.org/>.
- Go to <https://www.stlouisfed.org/education/page-one-economics-classroom-edition> to learn about nominal and real values and adjusting for inflation.
- Follow the instructions on Handout 1 to use FRED® to plot the nominal and real (or inflation-adjusted) values of the federal minimum wage. The URL to the completed version of the graph is <https://fred.stlouisfed.org/graph/?g=10jEG>.

Procedure

1. Tell the students that they will learn about the practice of adjusting dollar values for the effect of inflation.
2. Explain that inflation raises the general price level for goods and services in an economy and reduces the purchasing power of a dollar over time. This means that, year after year, with a fixed amount of money you're able to buy fewer items at the grocery store or access fewer services like haircuts or car repairs.
3. Explain that adjusting for inflation means measuring dollar amounts in constant prices. Economists use jargon to name dollar amounts that have been adjusted for the impact of inflation.
4. Write the terms "inflation," "minimum wage," "nominal," and "real" on the board and ask the students to provide definitions. (The following definitions are from the [econlowdown.org glossary](https://econlowdown.org/glossary)):

Inflation—A general, sustained upward movement of prices for goods and services in an economy.

Minimum wage—The lowest wage that employers may legally pay for an hour of labor.

Nominal—Monetary values, wages, or prices, measured in current prices.

Real—Monetary values, wages, or prices, adjusted for inflation and measured in constant prices—that is, in prices of a given or base period. Real monetary values are obtained by adjusting nominal wages or prices with a price measure such as the consumer price index (CPI).

5. Distribute a copy of Handout 1 to each student. Ask a volunteer to come to the front and follow the instructions to build the FRED® graph using the computer connected to the classroom projector.
6. Explain that it is important to decide when/if to use particular datasets. Direct students' attention to the data sources under the FRED® graph (the US Department of Labor and the US Bureau of Labor Statistics). Discuss the following:
 - Why does it matter to know what the source of the data is? (*Identifying the source can help with determining the credibility of the data.*)
 - What are some data sources that would be more/less authoritative? (*These data are probably the most authoritative for this particular exercise; less-authoritative data might be surveys with a small sample size, surveys that are relatively old, or data collected by a partisan group.*)
 - What else would you want to know besides the source to evaluate the data? (*The age of the data, to determine whether it is timely; the frequency at which the data were collected; and the length of the data series, to determine over what period the data were collected*)

OPTIONAL: Review unique features of FRED® graphs. For example, the shaded bars indicate US recessions, also known as economic downturns. The National Bureau of Economic Research (NBER) “calls” recessions and dates them. FRED® graphs display recession bars so that users can notice the impact of business cycles on economic data patterns.

7. Review the following basic strategies for establishing the reliability of a source:
 - **Determine if the source/aggregator has a credible reputation.** For example, FRED® can be considered credible because the Federal Reserve Bank of St. Louis is a well-established organization with a long-standing, non-partisan tradition.
 - **Be able to assert the independence of the data generator.** For example, in late 2009, the Hellenic Statistical Authority could not report macroeconomic statistics without fear or favor. (See [this euobserver.com](#) article on the topic.)
 - **Compare and contrast recurring anecdotal evidence against the data.** For example, developing countries with fixed exchange rates and high inflation rates release “official exchange rates” not truly reflecting the actual exchange value of their currencies. (See, for example, [this Financial Times](#) article.)

OPTIONAL: Arrange students into several groups, have them establish data reliability criteria independently, and then ask them to present their ideas to the class. Emphasize the common themes among their criteria and fill in the gaps in their arguments.

OPTIONAL: List a variety of sources of information on a single topic and have students work in small groups to evaluate and contrast the way each is constructed and what the goals of the tool are. (See the CPI example in this lesson’s appendix.) Ask each group the following:

- How are these data produced, and what is their purpose?

OPTIONAL: Highlight the fact that data are produced with varying frequency—some are daily, some hourly, some monthly, and some annual. Discuss the following:

- Why do you think different types of data are available with varying frequencies? (*Answers will vary, but students' attention should be directed to the cost, ease of collection, and importance of collecting information/data with higher [or lower] frequencies.*)

8. Explain that it is important to provide an accurate citation of data used. The citation gives the data provider credit and allows others to access the data and replicate research that used the data. Use the following elements of the suggested citation structure in FRED® as an example:

Data source; Series name; Series ID; Retrieval site; URL address; Date accessed

OPTIONAL: Discuss the format of data series IDs and the value of systematic naming for finding similar (or related) series. Discuss the following:

- What does a series ID mean?

In some cases, the series ID provides abbreviated descriptions of the data. For example, CAWRET = CA (California) + W (Wages and Salaries) + RET (Retail Trade)

In other cases, the series ID reflects database structures and codes. For example, SMU0600000420000001 = survey abbreviation (SM) + seasonal (code) (U) + state_code (06) + area_code (00000) + supersector_code (42) + industry_code (000000) + data-type_code (01)

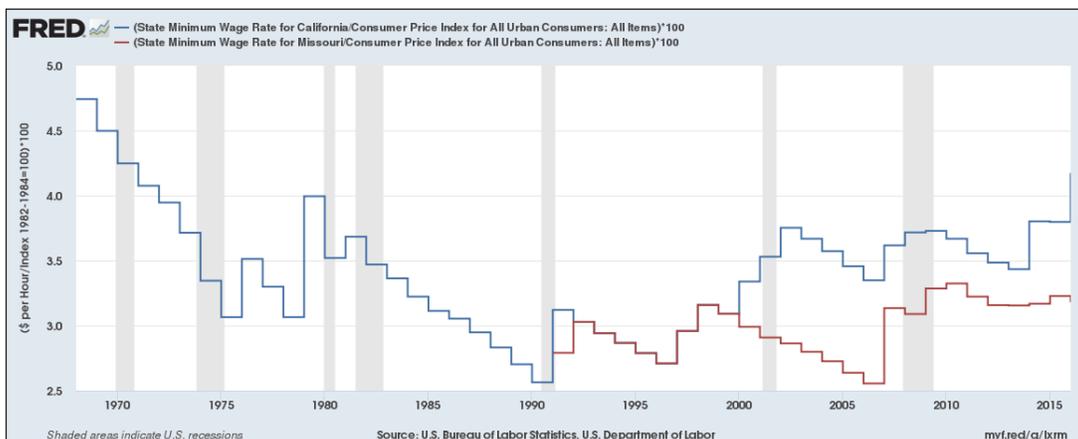
ACRL Information Literacy Frames as FRED®-Integrated Abilities

To further develop the concepts from the first portion of the lesson, students will create new graphs and discuss these graphs. They may work in pairs or small groups.

Plotting Nominal and Real Wages Across Individual States

NOTE: The figure is accessible through the following FRED® public dashboard: <https://research.stlouisfed.org/dashboard/18382>, which also includes the same graph-building steps and discussion questions provided below.

9. Distribute a copy of Handout 2 to each student. Assign each student a state minimum wage series from the following FRED® page: <https://fred.stlouisfed.org/categories/33831>.
10. Tell the students they will plot a FRED® graph of the state minimum wage series assigned and adjust the data for inflation using the formula $\text{real} = (\text{nominal}/\text{CPI}) * 100$. They will then add a similar series for another state (perhaps one they'd like to move to) and compare the two. Instruct the students to complete Handout 2. (NOTE: The figure was created using the steps in #2 on Handout 2 and minimum wage data for California and Missouri.)



Figure

11. Allow time for students to work, and then invite students to report the following information for the graphs created:
 - Sources: (State minimum wages: US Department of Labor; CPI: US Bureau of Labor Statistics)
 - Latest observations: (The last data point in each series)
 - Date updated: (Answers will vary based on when the graph was created. The updated date is found on the top left of each dataset's individual FRED® page.)
 - Frequencies: (State minimum wages: Annual; CPI: Monthly)

12. Discuss the following:
- What is a minimum wage? *(A price floor for paid work; the lowest wage that employers may legally pay for an hour of labor)*
 - Who decides a state's minimum wage? *(A state's minimum wage, or lack thereof, is generally controlled by the legislature within that state.)*
 - On FRED®, where do you find the source information for the data? *(In the "NOTES" section at the bottom of the page)*
 - What is the source of the minimum wage data? *(The source is the US Department of Labor, a federal agency.)*
 - Why does the date the data were updated matter? *(Data may not reflect current values; data that change frequently may not be accurate if they are months/years out of date.)*
 - Notice the different sources for the wages and the CPI data—the US Department of Labor and the US Bureau of Labor Statistics, respectively. How do the two agencies complement one another? *(The two agencies have separate responsibilities and employ different methodologies, so they each provide a different view of the data.)*
13. Emphasize that the students have produced a new piece of information—real wages—by combining two existing pieces of information (i.e., nominal wages and the price level). In this case, the whole of the new concept is larger than the sum of the two parts that make it. Stress that the sources of the data are important here. (You may want to reference spring water as a metaphor: What is the source? Where did it come from? What is inside it?)

Assessment

Choose from among the following activities:

In-Class Activities

- A. Have students report on individual or group work (a “verbal gallery walk”).
- B. Assign a “minute paper.” Have students write (or verbally state) their answers to the following questions, giving them a minute to answer each:
 - What worked during the lesson?
 - What was confusing about the lesson?
 - How will you apply what you learned today?
 - Other (optional) questions: What surprised you about what you learned today? What questions were left unanswered for you? Was there anything you did not understand?
- C. Develop a short, individual multiple-choice questionnaire with attitudinal statements such as the following: “Which of these statements do you agree with the most?”
 - I found the instructions to build the FRED® graph easy to follow.
 - I was surprised to learn about the differences in minimum wages across states.
 - I had a hard time building the FRED® graph on my own.
 - I now have a better understanding about citations and sources.
 - I want to learn more about the topic we discussed before making my mind up about it.

Out-of-Class Activities

- D. Assign a short written report in which students summarize what they learned during the instructional session and reflect on the in-class activities, identifying one aspect they thought worked well and one aspect they found confusing.
- E. Assign a short writing assignment, such as the following, in which students answer a follow-up question by building additional FRED® graphs and interpreting the data patterns:
 - Compare the real median household income between the state where you are now and the state you want to move to after graduation. For each state, how many hours would you have to work each year at the state’s current minimum wage rate to reach the state’s median income?
 - Compare the number of men and women holding multiple part-time jobs. How does that difference impact the total real earnings for all men and women—not just those employed full time?
 - Compare nominal and real median weekly earnings across age, sex, and race groups. What patterns do you observe?
 - The nominal (current-dollars) data are available here:
<https://fred.stlouisfed.org/release/tables?rid=332&eid=46373>.
 - The real (inflation-adjusted-dollars) data are available here:
<https://fred.stlouisfed.org/release/tables?rid=332&eid=46420&snid=46432>.

Resources

Adjusting for Inflation

<https://www.stlouisfed.org/education/page-one-economics-classroom-edition/adjusting-for-inflation>

Data Citations with FRED®

<https://www.stlouisfed.org/education/page-one-economics-classroom-edition/data-citations-with-fred>

The Great Inflation

https://www.federalreservehistory.org/essays/great_inflation

The Great Inflation Online Course for Teachers and Students

<https://www.stlouisfed.org/education/the-great-inflation-online-course-for-teachers-and-students>

Lack of Independence in the Hellenic Statistical Agency

<https://euobserver.com/economic/29258>

Nigerian Official and Parallel Exchange Rates

<https://www.ft.com/content/686ceaa5-81a6-375e-b4c1-e7a2981f52bf>

Data Manipulation and the Big Mac Index

<http://www.economist.com/node/18014576>

Data Manipulation and the Credibility of Official Statistics

<http://www.economist.com/node/21548242>

Glossary of Economics and Personal Finance Terms

<https://www.stlouisfed.org/education/glossary>

Handout 1

1. Plot a FRED® graph of the federal minimum wage series assigned and adjust the data for inflation using the formula $\text{real} = (\text{nominal}/\text{CPI}) * 100$, following the steps below:

Step 1. Use the FRED® (<https://fred.stlouisfed.org/>) search box to search for and select “Federal Minimum Hourly Wage for Nonfarm Workers for the United States, Dollars per Hour, Monthly, Not Seasonally Adjusted (FEDMINNFRWG).”, then click “Add to Graph” to create the graph.

Go to the “EDIT GRAPH” panel to complete the next steps:

Step 2. “ADD LINE.” Use the search box to search for and select “Federal Minimum Hourly Wage for Nonfarm Workers for the United States, Dollars per Hour, Monthly, Not Seasonally Adjusted (FEDMINNFRWG),” then click “Add data series.”

Step 3. “EDIT LINE 2”: Use the search box under “Customize data” to search for and select “Consumer Price Index for All Urban Consumers: All Items, Index 1982-1984=100, Seasonally Adjusted (CPIAUCSL),” then click “Add.”

Step 4. In the “Formula” box, enter “(a/b)*100” and click “Apply.”

Step 5. Use the date boxes above the graph to enter “1983-01-01” as the start date of the graph.

2. Identify the following information for the graph you created:

- Sources:
- Latest observations:
- Dates updated:
- Frequencies:

Handout 2

1. Select the assigned state minimum wage series from the following FRED® page:
<https://fred.stlouisfed.org/categories/33831>.
2. Plot a FRED® graph of the state minimum wage series assigned and adjust the data for inflation using the formula $\text{real} = (\text{nominal}/\text{CPI}) * 100$. Then add a similar series for another state (perhaps one you'd like to move to) and compare the two, following the steps below:
 - Step 1.** Use the FRED® search box to search for and select your first state minimum wage series, then click "Add to Graph" to create the graph.
Go to the "EDIT GRAPH" panel to complete the next steps:
 - Step 2.** "EDIT LINE 1": Use the search box under "Customize data" to search for and select "Consumer Price Index for All Urban Consumers: All Items, Index 1982-1984=100, Seasonally Adjusted (CPIAUCSL)," then click "Add."
 - Step 3.** In the "Formula" box, enter "(a/b)*100" and click "Apply."
 - Step 4.** Select "ADD LINE." Search for your second state minimum wage rate, select it, and click "Add data series."
 - Step 5.** "EDIT LINE 2": Use the search box under "Customize data" to search for and select "Consumer Price Index for All Urban Consumers: All Items, Index 1982-1984=100, Seasonally Adjusted (CPIAUCSL)," then click "Add."
 - Step 6.** In the "Formula" box, enter "(a/b)*100" and click "Apply."
3. Identify the following information for the graph you created:
 - Sources:
 - Latest observations:
 - Dates updated:
 - Frequencies:

Appendix

Example Optional Activity on Sources: CPI

In the procedure for this lesson, real wages are expressed as a ratio between nominal values and the consumer price index (CPI). The CPI is the most common measure of the cost of living in the United States used by economists and policymakers. It is useful to understand some basic facts about the CPI.

CPI: <https://www.bls.gov/cpi/questions-and-answers.htm>

- **What is it?** *It is an index that measures the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services.*
- **What's its source?** *The US Department of Labor–Bureau of Labor Statistics, a federal agency*
- **What's its frequency?** *Monthly*
- **Who holds the intellectual property rights for the CPI?** *A US federal agency collects the data, so they are in the public domain. This means they can be freely used.*

NOTE: CPI is the most frequently reported measure of inflation and the most popular series in FRED®. Inflation was high in the United States between 1965 and 1982, a period known as “The Great Inflation.” [This](#) online course, from Econ Lowdown of the Federal Reserve Bank of St. Louis, centers on this period and discusses the (bad) effects of high inflation.

There are alternatives to the CPI to measure the cost of living. These alternative price indexes can offer insights into relative prices across countries, differences in the cost of living, and different ways of collecting data. If you use different price indexes, the value of real wages will change. Some alternatives are the following:

Big Mac Index: <http://www.economist.com/content/big-mac-index>

- **What is it?** *It is an index that evaluates the exchange rate between currencies through the concept of “purchasing power parity.” It allows people to intuitively understand price differences and the cost of living across countries by showing the cost of a McDonald’s Big Mac hamburger in different countries.*
- **What's its source?** *The Economist, a weekly news magazine*
- **What's its frequency?** *Annual*
- **Who holds the intellectual property rights?** *The data are collected and owned by The Economist. This means the data cannot be reproduced without permission (but can be cited).*

NOTE: The Big Mac Index has been cited as evidence of statistical manipulation. In 2011, *The Economist* reported that the index strongly suggested that the Argentine government was [manipulating](#) its official statistics by underreporting the rate of inflation. As a response, allegedly, the Argentine government pressured local McDonald’s to either sell the Big Mac with other items (thus masking its price) or lower the price. *The Economist* wrote [this](#) article about the (lost) credibility of “fudged” data.

The Billion Prices Project: <http://www.thebillionpricesproject.com/>

- **What is it?** *It is a project that builds indexes using prices collected daily from hundreds of online retailers around the world. It is primarily intended for use by researchers.*
- **What's its source?** *It was started by two economists at the Massachusetts Institute of Technology (MIT) and is housed at that institution.*
- **What's its frequency?** *Daily*
- **Who holds the intellectual property rights?** *The project makes only historical datasets from peer-reviewed publications available and free to download.*

NOTE: This an example of what people sometimes refer to as “big data” because it uses millions or billions of micro-level transactions to capture changes in the cost of living.

Students might find it useful to explore other well-regarded indexes that are not price indexes:

Human Development Index: <http://hdr.undp.org/en/content/human-development-index-hdi>

Corruption Perceptions Index: <https://www.transparency.org/research/cpi/overview>

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Standards and Benchmarks

ACRL Information Literacy Frames and Knowledge Practices Aligned with This Lesson Plan

Research as Inquiry—Select Knowledge Practices

Learners who are developing their information literacy abilities

- draw reasonable conclusions based on the analysis and interpretation of information.

Information Creation as a Process—Select Knowledge Practices

Learners who are developing their information literacy abilities

- articulate the capabilities and constraints of information developed through various creation processes.

Authority Is Constructed and Contextual—Select Knowledge Practices

Learners who are developing their information literacy abilities

- use research tools and indicators of authority to determine the credibility of sources, understanding the elements that might temper this credibility and
- understand that many disciplines have acknowledged authorities in the sense of well-known scholars and publications that are widely considered “standard,” and yet, even in those situations, some scholars would challenge the authority of those sources.