The Information Creation Process: Data Sources and Data Aggregators

Data **LITERACY**

Authors

Kelly K. Kraemer, MLIS, College of St. Benedict and St. John's University

Bennett Frensko, MLIS, College of St. Benedict and St. John's University

Adam Konczewski, College of St. Benedict and St. John's University

Framework Alignment (see page 14)

Activity Rationale

The way that economic information is created and presented can shape our understanding of economic concepts and trends. The goal of this activity is to have students learn how information may be understood differently based on how it is created and how it is presented. By examining the differences between data sources and data aggregators, students will be able to identify capabilities and constraints of presenting data in different formats.

Activity Description

In this activity, students will examine and interact with two economic data websites—FRED®, of the Federal Reserve Bank of St. Louis, and the Bureau of Economic Analysis (BEA)—to develop their understanding of the information creation process. Students will learn about differences between data aggregators and data sources and the capabilities and constraints of each in presenting economic data. Students will look "under the hood" of gross domestic product (GDP) and its components by using the BEA's Full Release & Tables for GDP, and then they'll develop their skills in creating and editing graphs in FRED® by creating their own stacking area graph of GDP and its components. Finally, students will be asked to reflect on how different presentations of data can affect understanding of economic concepts.

Grade Level

High School, College

Objectives

Students will be able to

- articulate the differences, capabilities, and constraints of using an economic data source versus an economic data aggregator to understand content; and
- create, edit, and share a FRED® graph comparing GDP and several components of GDP.

Compelling Question

How do economic data aggregators differ from economic data sources?

Time Required

50 minutes

Materials

For each student:

- Handout, digital copy
- Personal computer or lab computer access
- Internet access
- An individual FRED® account with username and password

For the instructor:

- PowerPoint slide deck for "The Information Creation Process: Data Sources and Data Aggregators"
- Handout, digital copy
- Handout Answer Key, digital copy
- Computer with the following:
    - Internet access
    - Ability to connect to a projector, Smart Board, or large presentation monitor
- Projector, Smart Board, or large presentation monitor
- A personal FRED® account with the following graph saved:
    - Real Gross Domestic Product, Quarterly, Billions of Chained 2012 Dollars, Seasonally Adjusted Annual Rate,1947-01-01 to the latest observation
    - View graph at: https://fred.stlouisfed.org/series/GDPC1

Preparation

Before the activity, email a digital copy of *Handout: Real GDP Components* to all students or post it on the course management system where students can access it. Instruct students to do the following:

- Set up a personal FRED® account and watch the following eight short videos about using FRED®:
  - What is FRED®?
  - Changing Time Periods | How to Use FRED®
  - Changing Units | How to Use FRED®
  - Choosing Units | How to Use FRED®
  - Data Frequency | How to Use FRED®
  - Adding Data Series | How to Use FRED®
  - Removing Data Series | How to Use FRED®
  - Formatting Graphs | How to Use FRED®
- Create a single line graph for the following data series: "Real Gross Domestic Product Billions of Chained 2012 Dollars, Seasonally Adjusted Annual Rate" and save to your FRED® account. (Your graph should look like the one at https://fred.stlouisfed.org/series/GDPC1.)

Procedure

1. Display slide 1 of the PowerPoint slide deck to introduce the activity.

2. Display slide 2, which outlines differences between a data aggregator like the Federal Reserve Bank of St. Louis's data site, FRED®, and a data source like the Bureau of Economic Analysis (BEA). Discuss the following characteristics of aggregators like FRED® and sources like the BEA:
   - The Federal Reserve Bank of St. Louis's data site, FRED®, is an example of a data aggregator, while the Bureau of Economic Analysis (BEA) is an example of a data source.
   - The lines between aggregators and sources can be blurry, as some organizations and websites provide both services. But there are some common characteristics that can be used to distinguish the two.
     - Data aggregators typically collect economic data series from many different sources. They organize the aggregated data, make it searchable, and often provide tools for additional formatting and analysis.
     - Data sources are the original creators of economic data series. Sources are people or organizations that create the data by conducting original research and analysis, and they develop methodologies for how their data were calculated. Sources often provide regular releases to distribute new data.

3. Display the saved graph from the FRED® website on the projector/screen: https://fred.stlouisfed.org/series/GDPC1.

4. Explain that FRED® is a data aggregator, which means it is a database that aggregates economic data from many different data sources, including public, private, national, and international organizations. People at the St. Louis Fed work to organize the aggregated data and make it searchable, and they provide various tools for transforming and customizing data.

5. Discuss the following, referring to the displayed graph from the FRED® website (https://fred.stlouisfed.org/series/GDPC1):

    - Where do the data for this graph come from? (*The GDP data come from the Bureau of Economic Analysis [BEA], which is noted at the bottom of the graph and linked in the Notes section below the graph. The "Source" link takes the user to the BEA's website, while the "Release" link takes the user to the most recent release of GDP data that the FRED® graph has drawn from.*)

6. Navigate to the bottom of the graph to show students the BEA information. Explain that for every FRED® graph, the data source can be found below the time scroll bar at the bottom, where the source(s) for the graph's data series are named.

7. Scroll down the graph's web page to the Notes section and find the links to both the data source (usually the website of the organization that produced the data) and the release (the specific location on the source's website with the data relevant to the graph).

8. Explain that the data source, along with the specific release (or announcement) the source gave to share the data, is linked below every FRED® graph. The source link will take you to the home page of the data source, while the release link will take you directly to the data most relevant to the FRED® graph. The release link is useful because it's usually where you'll also find things like data documentation.

9. Demonstrate with the displayed graph by scrolling to the "Release" link for real gross domestic product and clicking on it so that the BEA page for gross domestic product is displayed to the class (https://www.bea.gov/data/gdp/gross-domestic-product). Discuss the following, explaining the BEA as a data source:

    - As a data source, the BEA is the original creator of the GDP data being used. This means that the BEA, the source, conducted the survey or did the measurements that produced the data that it shares and distributes.
    - The BEA is one of many U.S. statistical agencies that gather data, conduct research and analysis, and develop methodologies for estimating economic metrics.
    - Data sources are the original creators of economic data. Many sources for economic data are government organizations or agencies, but other sources might be private businesses, industry groups, or academic researchers. Discuss the following:

- What are some examples of other economic data sources? (*Answers will vary but may include anything from local or state government agencies to other national and international organizations that collect and share economic data.*)

- Other data source examples include the U.S. Census Bureau (USCB), Bureau of Labor Statistics (BLS), Congressional Budget Office (CBO), Organisation for Economic Co-operation and Development (OECD), and International Monetary Fund (IMF).
- Often, data sources do not perform the level of data organization that an aggregator like FRED® does. Users are expected to do their own work in organizing the data acquired from the source and make it usable with their own preferred analysis tools.

10. Display slide 3 (but keep the BEA web page open, to return to later in the activity). Introduce the Compelling Question, "How do economic data aggregators differ from economic data sources?" Explain that this is a question to consider as we move through the rest of the activity. We will revisit the question at the end of the session.

11. Display slide 4. Explain the capabilities and constraints of using data directly from the BEA to examine the components of GDP by discussing the following:
    - Both FRED® and the BEA provide economic data to researchers, but there are differences—capabilities and constraints—for each in creating something like a graph showing GDP to tell a story about the economy.
    - Capabilities of a data source like the BEA include that it is where the original data came from. This means that researchers can download the raw data tables (along with details on the methodologies used to create the data) for their own customized statistical analysis and data visualization, using the tools they feel best suit their needs. The original data source usually provides additional context, explanation, or expert analysis as part of a data release.
    - Constraints of a data source like the BEA include the lack of a clear connection to other economic data sources. Researchers would have to know about them or seek them out separately and then do the extra work of compiling and formatting the data themselves. Likewise, the data releases provided by sources like the BEA often only present the most recent data, and researchers must track down (or even create themselves) a longer time series.

12. Display slide 5. Explain the capabilities and constraints of using data from FRED® to examine the components of GDP by discussing the following:
    - Capabilities of a data aggregator like FRED® include the ability for users to search for and find economic data from many different sources, in one location. The tools FRED® provides allow users to compare data series from different sources easily in one graph, with no data clean-up or reformatting required from the user.
    - Constraints of a data aggregator like FRED® include the varying availability of analytical tools and the level of analysis it provides, which may not be suitable for advanced research needs. There is less documentation on data creation and methodology on an aggregator's website; a researcher would need to search for that documentation from the data source.

13. Display the true/false statements on slides 6-11 to review the characteristics, capabilities, and constraints of data aggregators and data sources. Tell students that after each question is posed on a slide, they should give a "thumbs up" if they think the statements is true and a "thumbs down" if they think the question is false. Work through the following:

    - **Statement 1:** FRED® is the original source of U.S. GDP data. (*False. The BEA is the source.*)
    - **Statement 2:** An organization that uses original methods to gather data and conduct research and analysis is an example of a data source. (*True*)
    - **Statement 3:** An organization that collects, organizes, and makes available data from many different sources in one location is an example of a data aggregator. (*True*)
    - **Statement 4:** A capability of a data aggregator is that it often provides more context and details on how the data are produced, gathered, and calculated. (*False. This is a capability of a data source.*)
    - **Statement 5:** A constraint of a data source is that it is difficult to connect with data series produced by other organizations or researchers. (*True*)

14. Return to displaying the GDP line graph that was previously shown to students on the FRED® website: https://fred.stlouisfed.org/series/GDPC1. Instruct students to use their computers/devices to log in to their personal FRED® accounts and pull up the graph they each created prior to the activity.

15. Review the graphs that each student was asked to create in the pre-class activity/assignment; use them as a starting point for the remaining discussion and demonstrations. Instruct students to follow along on their own computers, modifying their graphs as you demonstrate transforming and customizing the data.

16. Demonstrate finding additional context from an original data source, using the BEA's Full Release & Tables as an example, as follows:

    - Display the GDP line graph from the FRED® website.
    - In the Notes section below the graph, click on the "Release: Gross Domestic Product" link to get to the BEA web page for GDP (https://www.bea.gov/data/gdp/gross-domestic-product). Find the "Current Release" menu below the BEA graph and click on the "Full Release & Tables" link. The PDF for the BEA's News Release should now be displayed: https://www.bea.gov/sites/default/files/2021-11/gdp3q21_2nd.pdf.
    - Navigate to p. 10 in the PDF to find Table 3 with the data FRED® used in its line graph. Remind students to follow along on their computers.
    - Explain that this table shows a portion of the exact same data as the line graph in FRED®, listing the seasonally adjusted annual rates in billions of chained 2012 dollars for the past two years. What's interesting about this table is that it also presents a detailed breakdown of the different components and subcomponents that contribute to GDP.

- On p. 11 of the PDF, highlight the rows for Net exports of goods and services, Exports, and Imports in the table (lines 43, 44, 47). Describe how Net exports of goods and services, Exports (Imports) can offer additional insight into GDP and that they can be added to the FRED® graph.
- Explain that Net exports is one of the components of GDP, in addition to other components such as Personal consumption expenditures, Gross private domestic investment, and Government consumption expenditures and gross investment.
- Explain that the tables in the PDF reveal the subcomponents that go into the calculation of Net exports. The two big ones are Exports and Imports, which in turn have several components that go into their own calculation. These tables reveal the layers of complexity that go into GDP as an economic measurement.

17. Now demonstrate graph editing and formatting functions in FRED®, adding Net exports to the FRED® graph to visualize how it contributes to GDP, as follows:
    - Return to displaying the GDP graph in FRED® (https://fred.stlouisfed.org/series/GDPC1). Click on the orange "Edit Graph" button in the top right of the page. Click on the "Add Line" tab and demonstrate searching for and adding the data series for "Real Exports of Goods and Services" (https://fred.stlouisfed.org/graph/?g=KrAK).
    - Explain that Net exports shows the actual contribution of international trade to GDP. It is calculated as ***Exports – Imports***. We use Net exports, rather than Exports and Imports as separate data series, so that we don't over- or under-calculate real GDP.
    - Demonstrate editing the line for Real Exports of Goods and Services by adding another data series in the "Customize data" section of the "Edit Line 2" menu. Show students how to search for and select "Real Imports of Goods and Services" (https://fred.stlouisfed.org/graph/?g=KrB4).
    - Demonstrate using the "Formula" field under "Customize data" to subtract Real Imports of Goods and Services [IMPGSC1] from Real Exports of Goods and Services [EXPGSC1]. The formula should be "a – b." The graph displayed should now look like this: https://fred.stlouisfed.org/graph/?g=JWzz.
    - Demonstrate how to modify the graph time scale, using the pre-set year options "1Y, 5Y, 10Y, Max"at the top of the graph, the specific time-range boxes, or the sliding time bar at the bottom of the graph.
    - Demonstrate how to create an area graph. In the "Edit Graph" menu, navigate to the "Format" tab and change the Graph type from "Line" to "Area."
    - At the end of the demonstration, both instructor and students should have a graph that looks like this: https://fred.stlouisfed.org/graph/?g=JVCj.

18. Display slide 12. Direct students to each open a copy of *Handout: Real GDP Components* on their own computers. Remind them that the handout was distributed to them prior to class via email or the course management system.

19. Display slide 12 and explain the handout to the students, as follows:
    - Use the handout to continue to examine other GDP components, making use of both the BEA's Full Release & Tables and the FRED® area graph that we just worked on.
    - Follow the instructions to add the three additional data series listed on the slide and on your graph.
        - Real Personal Consumption Expenditures [PCECC96]
        - Real Gross Private Domestic Investment [GPDIC1]
        - Real Government Consumption Expenditures and Gross Investment [GCEC1]
20. After students finish answering the questions on the handout, display slide 13. Facilitate a group discussion that leads to students answering the Compelling Question, "How do economic data aggregators differ from economic data sources?"
    - What is an economic data aggregator? (*It's an organization that creates a database that aggregates/collects economic data from many different data sources, including public, private, national, and international organizations. The organization does the work to make the data organized and searchable, and it often provides some tools for transforming and customizing data.*)
    - Name an example of a data aggregator. (*FRED® from the St. Louis Fed, World Bank, International Monetary Fund, OECD*)
    - What is a data source? (*It's the original creator of economic data. Many sources for economic data are government organizations or agencies, but other sources might be private businesses, industry groups, or academic researchers.*)
    - Name some economic data sources. (*Bureau of Economics Analysis [BEA], Bureau of Labor Statistics [BLS], U.S. Census Bureau*)
    - How does seeing the real GDP data in a graph through FRED®—a data aggregator—differ from seeing the data in tables on the BEA site? (*Answers will vary but may include the following:*

      FRED®
        - *It is easier to visualize long-term changes in the FRED® graph*.
        - *Researchers using a graph can make quick comparisons with other data series*.
        - *It's easier with a graph to see data's time-series relationships*.
        - *Using a graph can make it easier to see the relationship between GDP and its components*.

      BEA
        - *The BEA's Full Release & Tables provides detailed data for a shorter period*.
        - *The BEA's release tables are organized to present data from all the components and subcomponents that make up GDP*.
        - *The tables illustrate the complexity of GDP as an economic measurement*.
        - *It's easier to quickly look up specific data points and compare values reading tables*.)

21. At the end of class, students should submit their completed handout to the instructor via email or their course management system.

Assessment

22. Students will be assessed based on their responses in class and their completed work on the handout. Criteria include the ability to

    - articulate the differences, capabilities, and constraints of using an economic data source versus an economic data aggregator; and
    - create, edit, and share an area graph in FRED® comparing GDP and several components of GDP.

Handout: Real GDP Components (page 1 of 2)

During class, you created an area graph of Real Gross Domestic Product using the following data series:

- Real Gross Domestic Product [GDPC1]
- Real net exports, calculated as:
  Real Exports of Goods and Services [EXPGSC1] – Real Imports of Goods and Services [IMPGSC1]

Use the following GDP components to answer the questions below. Pay close attention to the bracketed codes for each series:

- Real Personal Consumption Expenditures [PCECC96]
- Real Gross Private Domestic Investment [GPDIC1]
- Real Government Consumption Expenditures and Gross Investment [GCEC1]

Find each of the above GDP components in the BEA's Full Release & Tables, which is found on the BEA website (https://www.bea.gov/data/gdp/gross-domestic-product) in the "Current Release" menu (https://www.bea.gov/sites/default/files/2021-11/gdp3q21_2nd.pdf). Go to Table 3 on pp. 10-11 of the release and look up each GDP component.

1. What are the two major (bolded) subsets of each of the following GDP component?
   a. The two major subsets of Personal consumption expenditures:
      - _____
      - _____
   b. The two major subsets of Gross private domestic investment:
      - _____
      - _____
   c. The two major subsets of Government consumption expenditures and gross investment:
      - _____
      - _____

2. Add the above three components to the GDP stacking area graph you created in class. Save the graph and paste a link to it below:

Handout: Real GDP Components (page 2 of 2)

3. What are some differences between using the BEA's release table and using a FRED® graph for examining GDP data? Use the table below for your answers.

FRED®	BEA

Handout: Real GDP Components—Answer Key (page 1 of 2)

During class, you created an area graph of Real Gross Domestic Product using the following data series:

- Real Gross Domestic Product [GDPC1]
- Real net exports, calculated as:
  Real Exports of Goods and Services [EXPGSC1] – Real Imports of Goods and Services [IMPGSC1]

Use the following GDP components to answer the questions below. Pay close attention to the bracketed codes for each series:

- Real Personal Consumption Expenditures [PCECC96]
- Real Gross Private Domestic Investment [GPDIC1]
- Real Government Consumption Expenditures and Gross Investment [GCEC1]

Find each of the above GDP components in the BEA's Full Release & Tables, which is found on the BEA website (https://www.bea.gov/data/gdp/gross-domestic-product) in the "Current Release" menu (https://www.bea.gov/sites/default/files/2021-11/gdp3q21_2nd.pdf). Go to Table 3 on pp. 10-11 of the release and look up each GDP component.

1. What are the two major (bolded) subsets of each of the following GDP component?
   a. The two major subsets of Personal consumption expenditures:
      - *Goods*
      - *Services*
   b. The two major subsets of Gross private domestic investment:
      - *Fixed investment*
      - *Change in private inventories*
   c. The two major subsets of Government consumption expenditures and gross investment:
      - *Federal*
      - *State and local*

2. Add the above three components to the GDP stacking area graph you created in class. Save the graph and paste a link to it below:

   Students should provide a URL link to the graph they created in FRED®. The graph should look like this: https://fred.stlouisfed.org/graph/?g=JVCq (coloring may vary).

Handout: Real GDP Components—Answer Key (page 2 of 2)

3. What are some differences between using the BEA's release table and using a FRED® graph for examining GDP data? Use the table below for your answers.

   Answers will vary but may include the following variety of points that touch on the capabilities, constraints, or general differences between data sources and data aggregators:

FRED®	BEA
User can view more data series in one location. *Graphing tools allow data to be formatted as needed.* *It is easier to search and compare multiple time-series datasets.* *Long-term trends are easier to see.* *Individual data points can't be read and viewed in the same manner as a table.*	*Can view specific data points and compare them individually.* *Can view data in original format and context.* *Long-term trends are hard to see. Limited to three years in the release table.* *Tables limit the amount of data that can be viewed at once.*

Framework Alignment

ACRL Framework: Information Creation as a Process

Information in any format is produced to convey a message and is shared via a selected delivery method. The iterative processes of researching, creating, revising, and disseminating information vary, and the resulting product reflects these differences.

Knowledge Practices

- Articulate the capabilities and constraints of information developed through various creation processes.
- Recognize that information may be perceived differently based on the format in which it is packaged.