

# DATA Act Dashboard: An Instructional Case Using Data Visualization

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**ABSTRACT:** This case instructs students on how to extract, transform, and load data (ETL) from disparate sources to perform analysis on Federal Government agency spending transactions: the financial statements of the U.S. Government Accountability Office, DATA Act spending data, and Office of Management and Budget object class definitions. Students also learn to construct an interactive dashboard to allow users to discover and investigate agency spending data and to drill down to specific dimensions, such as program activity or object classification, and to specific standard general ledger accounts used by the Federal Government. A companion case demonstrates how to use robotic process automation to automate some of the ETL steps. This case is designed to be flexible so that it can be implemented in any undergraduate or graduate accounting course from government accounting and auditing to data analytics based on the instructor's preference.

**JEL Classifications:** H61; M41; M42; M48.

**Data Availability:** All data are publicly available.

**Keywords:** data visualization; DATA Act; data analytics.

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Supplemental material can be accessed by clicking the links in Appendices A and C.

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## I. THE CASE

### Introduction

Each fiscal year, Congress passes a funding bill that the president signs. The signed bill appropriates funds to the federal government and designates funds for specific purposes or programs. Federal government agencies are designated for specific purposes—such as defense, education, or social security—to implement and manage specific programs such as payments to retired military, school improvement, and social security payments. As funding is designated, agencies receive the funds in an appropriation account (similar to a bank account) called the Treasury Account Symbol (TAS) and draw down funds to support program operations. If funding bills for appropriations are not passed and signed, a continuing resolution (CR) may be enacted or the government will proceed with a shutdown of agencies and programs not funded.

Since the passage of the Chief Financial Officers Act of 1990 and subsequent Acts, agencies have made strides in achieving an opinion from their auditors. The federal government uses standard accounting practices, general ledgers, and data to receive budgets, track expenditures, and report on financial results. Agencies submit quarterly financial information electronically to the Department of the Treasury (see, <https://home.treasury.gov/>). Twenty-four agencies, generally the largest agencies, have been designated as CFO Act Agencies. They produce Annual Financial and Performance Reports that are published on the respective websites. Agency Inspector Generals are responsible for performing agency statement audits. The Treasury, in coordination with the Office of Management and Budget (OMB; see, <https://www.whitehouse.gov/omb/>), is responsible for preparing the Government's Financial Report by compiling individual agency's audited financial statements and reports. Statements are prepared in conformance with U.S. Generally Accepted Accounting Principles (GAAP) as promulgated by the Federal Accounting Standards Advisory Board (FASAB; see, <https://fasab.gov/>).

The U.S. Government Accountability Office (GAO; see, <https://www.gao.gov/>), the supreme audit agency of the U.S. federal government, provides Congress and federal government agencies with information on how taxpayer dollars are spent to help the government work more efficiently by improving operations across the government. Thus, the GAO is often called the “watchdog” for Congress.<sup>1</sup> The GAO is required by law to audit the government financial statements.

### The DATA Act and USAspending.gov

The U.S. government implemented initiatives in recent years that rely on data to report key performance indicators to analyze and manage the delivery of government services. One of these initiatives is the Digital Accountability and Transparency Act of 2014 (Public Law No. 113-101), also known as the DATA Act. The DATA Act mandates a financial reporting standard that all government agencies follow to report financial spending information to the U.S. Treasury Department (Treasury) and the Office of Management and Budget (OMB). The DATA Act also requires the Treasury to publish the spending data for open access to provide citizens information on how taxpayer money is spent. It is the nation's first open data law. Additionally, the DATA Act requires federal contractors and grant recipients to submit their reports using standardized data. USAspending.gov is the official source for spending data for the U.S. government. Understanding the relationship to the DATA Act is relevant to understanding the quality and value of the data.

<sup>1</sup> See, for example, “About the GAO” at: <https://www.gao.gov/about/>

To respond to the DATA Act, OMB and the Treasury worked together to develop a data schema identifying the key data and validations to be collected and then represented on the website. The DATA Act Information Model Schema (DAIMS) includes reporting information flows, interface definitions, diagrams, dictionaries, and XBRL schema files. The XBRL files are machine-readable versions of the data standard, including accounting-related and award-related content. The Treasury also developed a DATA Broker, which is essentially a process for collecting, storing, and validating the data. The Treasury then proceeded to develop a modern website where the data are published and can be researched by agencies, stakeholders, and the public. The comprehensive spending data used in this case will be pulled from the USAspending website (see, <https://www.usaspending.gov/>).

The DATA Act requires the GAO to report on the timeliness, completeness, accuracy, and quality of the data submitted by all agencies under the act, implementation, and use of data standards. In its first report to Congress in November 2017, the GAO found that “data accuracy—measured as consistency between reported data and authoritative agency sources—differed sharply between budgetary and award records” (GAO 2017).

To manage and track the activity of the funds from recording to reporting, a string of alpha and numeric characters (descriptive data) follows the transactions as the funds are used. The combination of the descriptive data and dollar amounts recorded in the appropriate general ledgers supports the required reporting back to the Treasury, Congress, the President, and ultimately the public. For the public to access this information at an entity level, two sources are available, the entities’ or agencies’ financial and performance statements and data on <https://www.usaspending.gov/>.

### Your Responsibilities

As a part of the audit team in the Office of Inspector General (OIG) at the GAO, one of your primary responsibilities is to consider the data accuracy of the GAO’s own federal spending data each quarter. In addition, the Inspector General has asked you to analyze the detailed spending information by line-item and by program activity, because analyzing spending patterns provides insights to management with the understanding to re-program or reallocate funding based on need and priorities. The Inspector General would like you to build a solution to allow her and others in the office to investigate spending patterns each quarter.

To accomplish this task, you need to first extract data from the DATA Act files in USAspending and from the GAO’s website, transform the data, and load the transformed data to a data visualization tool. Using that tool, you will then visually analyze the data to discover information about the entity’s spending and to enable a comparison of the data in <https://www.usaspending.gov/> to the GAO financial report. Because others in the OIG wish to routinely investigate the spending, you have decided to create an interactive dashboard to allow the user to select different spending dimensions and to be able to drill down to specific standard general ledger accounts.

## **II. PURPOSE OF THE CASE**

The purpose of the case is to increase awareness of data analytics and to expose students to a variety of data analytics skills necessary to enter the workforce given the changing nature of work in the accounting profession. PricewaterhouseCoopers (PwC), one of the Big Four accounting firms, states that the ideal candidate for both tax and audit roles should develop specific technology skills such as data wrangling, data analytics, and data visualization (PwC 2018). The

activities in this case include all aspects of this recommendation. It also meets the definition of data analysis, which is defined as the “process of inspecting, cleaning, transforming, and modeling Big Data to discover and communicate useful information and patterns, suggest conclusions, and support decision making” (Cao, Chychyla, and Stewart 2015).

The case also responds to PwC’s call for students to “develop a basic understanding of emerging technologies, including how they can be used to solve business issues in *industry-specific scenarios*” (PwC 2018; emphasis added). This case introduces students to the DATA Act and to federal agency reporting while also increasing their understanding of data wrangling and data visualization techniques.

Students who satisfactorily complete all parts of the case will be able to meet the following learning objectives:

1. Increase awareness of the Digital Accountability and Transparency Act of 2014 and the Chief Financial Officer’s Act of 1990.
2. Understand how technology is impacting government agencies.
3. Extract data from multiple sources including scraping data from PDFs.
4. Load data into a Tableau database and create joins to connect various data sources.
5. Transform and manage data to include cleansing, creating calculations, and writing code to design parameters.
6. Apply critical thinking skills.
7. Become more proficient in data visualization techniques.

### III. CASE REQUIREMENTS

The DATA Act Dashboard case is a comprehensive series of activities that include background readings and hands-on experience wrangling and analyzing Big Data. The primary objective of the case is to introduce students to more advanced data visualization skills and for students to learn to extract, transform, and load data into a downstream application used for analysis. This case also provides students with an opportunity to learn about and to analyze federal agency spending using a live data source.

#### A. Background Readings and Activities

For this case, you will analyze data from three sources: The financial statements of the U.S. Government Accountability Office, DATA Act spending data, and Office of Management and Budget object class definitions. Before conducting any kind of data analysis, however, it is essential to understand the underlying data. To accomplish this understanding, you will complete readings to increase your knowledge of the CFO Act of 1990 and the DATA Act data. Also, you will visit the interactive DATA Lab website to not only understand how the DATA Act has transformed agency reporting, but to also understand how technology is impacting government accounting and to visually learn about the data itself.

1. View the following list created by the SEC to learn the many ways your federal tax dollars are being used to work for us (SEC 2018): <https://www.sec.gov/spotlight/sec-employees/psrw50ways.pdf>
2. Before you learn about the DATA Act in the readings that follow, visit the DATA Lab to visualize government spending in action. The Data Lab is a platform that accesses the DATA Act spending data to provide interactive data visualizations to help citizens learn how the government allocates tax dollars (U.S. Department of the Treasury, Office of the

Chief Data Officer at the Bureau of the Fiscal Service 2021). The DATA Lab can be accessed at the following URL: <https://datalab.usaspending.gov/>

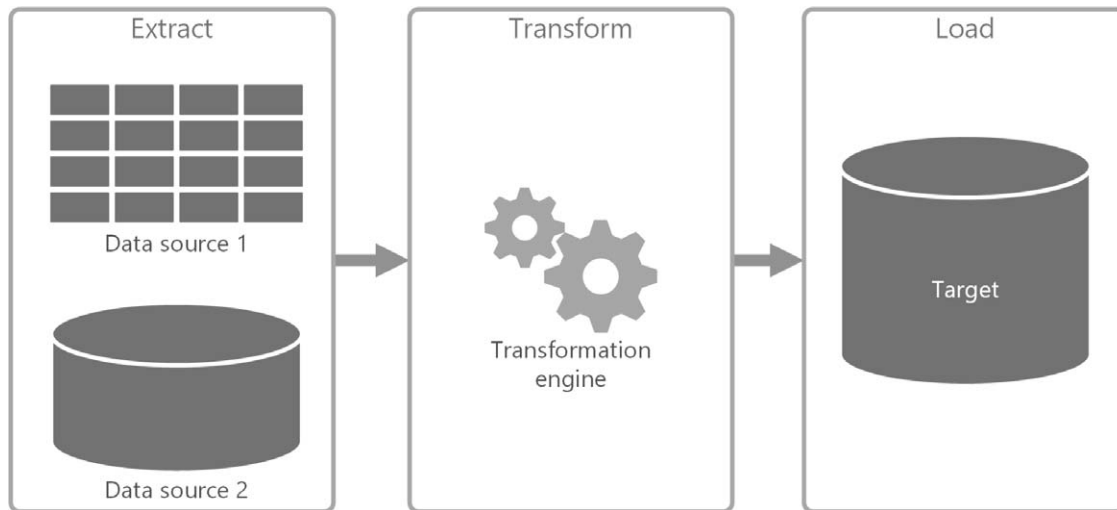
From this website, link to and view the Daily Treasury Statement dashboard to see how much the federal government spends in total each day. Hover over the data points on the chart to review daily, month-, and year-to-date spending. Expand the chart range to include March 17, 2021. Transactions on that date include monies spent after Congress approved the COVID-19 economic stimulus plan.

Next, scroll down the webpage to link to the Budget Function visualizations to learn how federal spending relates to the government's main functions. A Sankey diagram shows Budget Function on the left and Object Class on the right. Budget Function categorizes spending by mission or function of the federal government, such as social security or national defense. Object Class explains what the government received in exchange for the spending, such as employee salaries and rent. Click on a Budget Function category on the left to see how spending breaks down into Object Classes and *vice versa*.

3. The Digital Accountability and Transparency Act of 2014 (DATA Act) mandates a financial reporting standard that all government agencies follow to report financial spending information to the U.S. Treasury Department (Treasury) and the Office of Management and Budget (OMB). The DATA Act also requires the Treasury to publish the spending data for open access to provide citizens information on how taxpayer money is spent. It is the nation's first open data law. Read more about the DATA Act at the following website: <https://www.datacoalition.org/issues/data-act/>
4. To improve the financial management of federal agencies, the Chief Financial Officer's (CFO) Act of 1990 requires the preparation and audit of annual financial statements for 24 U.S. federal agencies. Before you work with the data in this case, learn about the CFO Act by reading "The Chief Financial Officer's Act: A Mandate for Federal Financial Management Reform," GAO/AFMD-12.19.4 CFO Act (GAO 1991), available at the following URL: <https://www.gao.gov/products/afmd-12.19.4>
5. The DATA Act requires agencies to report spending by object class. Each specific object class is defined in OMB Circular A-11 Section 83 (U.S. Office Management and Budget, Executive Office of the President 2020). Skim the object class definitions contained in the following document: [https://www.whitehouse.gov/wp-content/uploads/2018/06/a11\\_web\\_toc.pdf](https://www.whitehouse.gov/wp-content/uploads/2018/06/a11_web_toc.pdf)
6. Technology affects the federal government in much the same way as other areas of business. Read the following article on how technology impacts government accountants specifically: Glenn, Hill, and Wetklow (2019). The ABCDs of technology and impacts on federal financial management. *The Journal of Government Financial Management* 67 (4): 42–47.
7. The use of data analytics by the federal government to increase operational efficiency and to reduce risks continues to increase. For example, data visualizations help government accountants complete three-way matching for vendor payment processing and to flag high risk transactions for additional analyses to comply with the Improper Payments Elimination and Recovery Act of 2010 (IPERA). Like the dashboard you will create in this instructional case, agencies have also implemented spending dashboards to enable management to drill down aggregate spending by program activity, object class, and general ledger account code.

While examples of how data visualization is used internally by the Federal Government are

**FIGURE 1  
ETL Process**



Source: <https://docs.microsoft.com/en-us/azure/architecture/data-guide/relational-data/etl>

not available publicly, for this activity, visit the following agency websites to see examples of how the federal government is increasingly making data publicly facing through the power of data visualization:

- The U.S. Department of Agriculture Economic Research Service (2021; USDA). See, <https://www.ers.usda.gov/data-products/data-visualizations/>
- The U.S. Census Bureau. See, <https://www.census.gov/library/visualizations/interactive.html>
- The U.S. Department of Education: Education Stabilization Fund (2021)

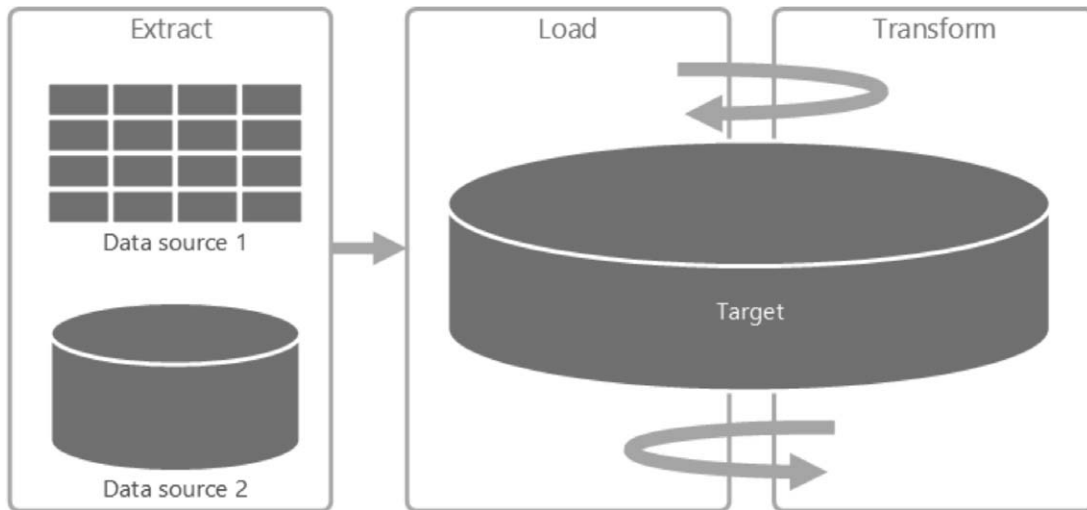
### **B. Extract, Transform, and Load (ETL)**

This part of the case centers specifically on the Extract, Transform, and Load (ETL) process—a fundamental component of data analytics. The main goal of the ETL process is to collect data from various sources, update the data depending on business rules, and push the data into a single target application. For this case, the destination structure is Tableau Desktop, a data visualization tool, which helps you to prepare, create, explore, and visualize a dataset to uncover hidden insights from the data using interactive worksheets and dashboards. You will commonly hear references to the “data pipeline” when working with ETL operations. The typical pipeline is depicted in Figure 1, where the ETL steps are performed sequentially.

The first step of the ETL process is to extract data from outside sources. The data transformation that takes place usually involves various operations, such as filtering, sorting, aggregating, changing data characteristics, removing duplicates, creating calculated fields, joining, and validating the data. Typically, the data transformation part of ETL is the most challenging. It is also the most time-consuming part of the entire project.

Sometimes, instead of using a separate transformation engine, the processing capabilities of the destination structure are used to transform the data. Tableau Desktop, our target application, is

**FIGURE 2  
ELT Process**



Source: <https://docs.microsoft.com/en-us/azure/architecture/data-guide/relational-data/etl>

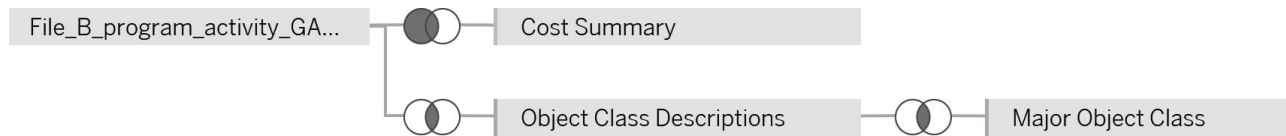
powerful enough to transform the data efficiently. As shown in Figure 2, this simplifies the architecture by removing the transformation engine from the pipeline. That is, the data store that transforms the data is the same data store that is used to complete the data analysis.

For this part of the DATA Act Dashboard case (ETL), you will gather data from three sources: The annual financial performance report of the U.S. Government Accountability Office, DATA Act spending data, and Office of Management and Budget object class definitions. You will then transform and clean the data to integrate the data for use in the target application, Tableau Desktop. You will also create calculations and parameters to be used in the interactive dashboard that you will complete in the second part of this case.

### ETL Requirements

1. *Extract and Transform GAO Performance and Accountability Report:* The GAO reports are available on the agency’s website as PDF documents. For the data extraction, you will download the most recent fiscal year report and locate and scrape the cost summary table from the PDF into an Excel spreadsheet.
2. *Extract and Transform OMB Object Class Descriptions:* For this data extraction, you will copy and paste the object class codes and object class descriptions provided by your instructor and create two worksheets in Excel.
3. *Extract DATA Act Spending Data:* To extract the DATA Act data, you will locate and download the File B Program Activity text file from the USAspending website for the period that corresponds to the GAO performance report you obtained in Step 1 above.
4. *Load and Transform DATA Act Data:* In Tableau Desktop, you will load the File B Program Activity text file and prepare the data for joining with the other data sources. To accomplish the data preparation, you will change variable data types, create calculations to trim data,

**FIGURE 3**  
**Data Source Joins**



and match data formats with the other sources. You will also learn how to manage the data, which is useful when working with many variables.

5. *Join the Data Sources:* You will then join the other data sources with the File B data in Tableau desktop. In particular, you will create a left outer-join to connect the File B and GAO performance report (cost summary); an inner-join to connect the File B and object class definitions; and an inner-join to connect the object class definitions with the major object classifications. Figure 3 illustrates the completed join canvas that will appear in Tableau after completing this requirement.
6. *Create Parameters for the Data Visualization:* In the second part of the case, you will create visualizations and a dashboard that allows the user to choose various dimensions, such as object classification or program activity, and measures, such as gross outlays or specific U.S. standard general ledger accounts. To accomplish this, you will create parameters and calculations for the dimensions and measures as the final step in the ETL process.

### **C. Data Visualizations**

Business intelligence (BI) combines mining, visualizing, and analyzing data from business operations and activities to optimize performance. BI provides a comprehensive view of the data, which is used to drive change. Read the following article to understand how modern business intelligence works and how it differs from traditional business intelligence. Tableau Software, “What is business intelligence? Your guide to BI and why it matters” (Tableau Software 2021), available at the following URL: <https://www.tableau.com/learn/articles/business-intelligence>

Data visualization is the graphical representation of data. It is an important tool for making sense of Big Data by telling “stories” that make data easier to understand. Data visualization helps the analyst to identify trends or patterns in the data and to quickly see outliers that warrant further investigation.

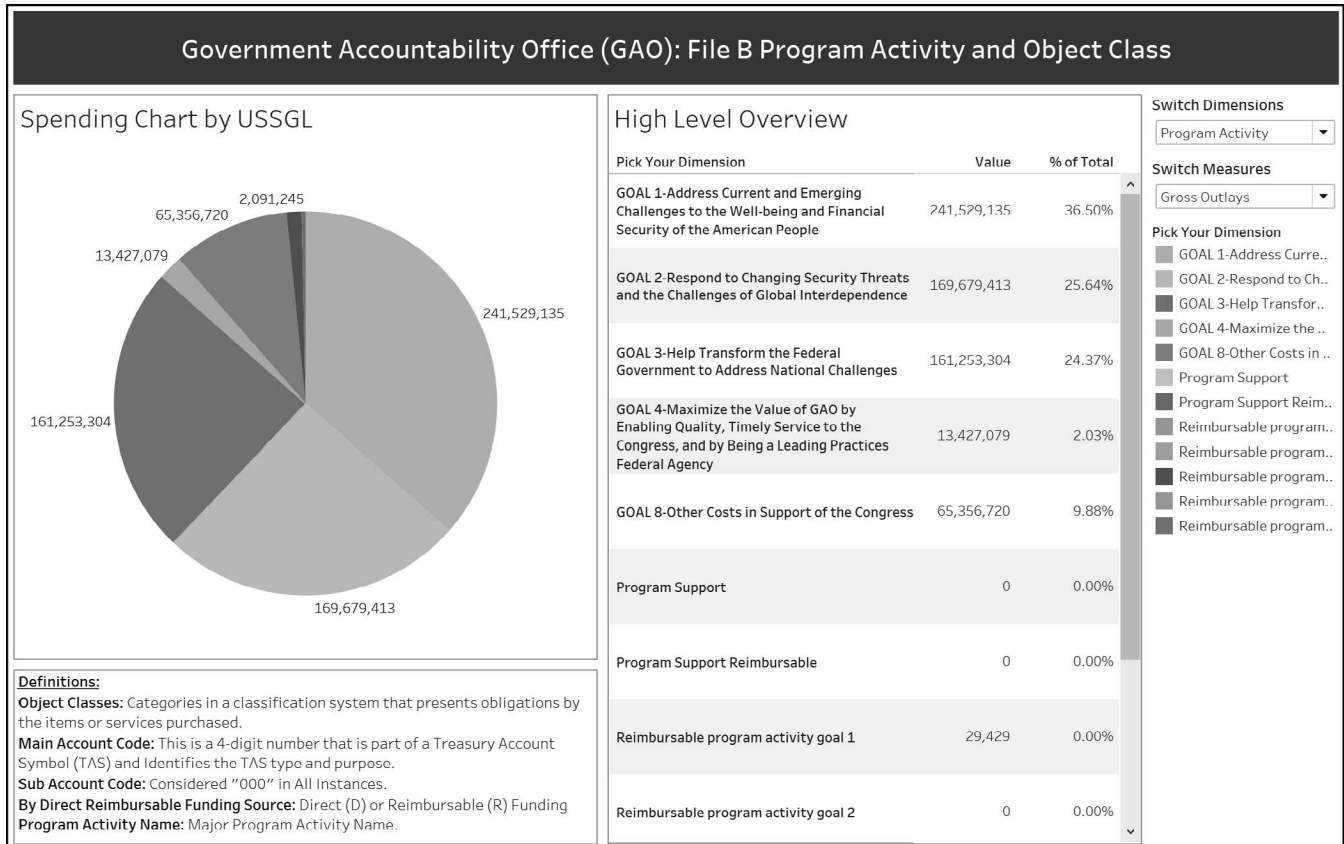
When completing the DATA Act Dashboard case, you will visually analyze data from three sources: The financial statements of the U.S. Government Accountability Office (GAO), DATA Act spending data, and Office of Management and Budget (OMB) object class definitions. All three data sources have been extracted, transformed, and loaded to a single Tableau packaged workbook, named “DATA Act Dashboard.”<sup>2</sup>

For this part of the case, you will create various types of data visualizations from a variance analysis to interactive pie charts. You will also create a dashboard for users to analyze the data on

<sup>2</sup> The packaged Tableau workbook was created from completing the ETL part of this case.



**FIGURE 4  
DATA Act Dashboard**



The full-color version of Figure 4 is available for download, see the link in Appendix A.

various partitions of the agency spending from dimensions that include program activities and object classifications to federal government standard general ledger accounts.

**Visualization Requirements**

1. *Financial Reporting Variance Analysis:* Using Tableau, you will create a variance report (text graph) to investigate the accuracy and consistency of the GAO’s spending transactions uploaded to USAspending and the amounts reported on the GAO performance report.
2. *Spending Analyses:* You will then create four progressively difficult visualizations to analyze how spending is broken down by various dimensions, including program activity and object classification.
  - A single-dimension pie chart that you will create to illustrate the efficiency of the multi-dimension chart that you will eventually complete. In this case, the pie chart will break down spending by program activity only.
  - The second single-dimension pie chart you will create will break down spending by object class. This chart will include a filter for major object class.

- Instead of having separate worksheets to analyze spending for different dimensions, you will now create a multi-dimension, interactive pie chart that allows users to pick the dimension that will be used in the analysis.
- Next, you will create an interactive pie chart that allows users to not only pick the dimension that will be used in the analysis but also a specific standard general ledger account as the measure. This visualization will be used in the final deliverable of the case, the DATA Act Dashboard.
- Similar to the variance analysis described above, you will create a worksheet that displays the dimensions and measures in a text graph to be used in the dashboard for additional views of the data that will interact with the dimensions and measures chosen by the user. This “high-level overview” visualization will also be used in the dashboard.
- Finally, you will create a dashboard that includes your multi-dimension, multi-measure pie chart, the high-level overview, and a few helpful references. The completed dashboard is depicted in Figure 4.

## REFERENCES

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## APPENDIX A

JOGNA-2021-004\_Figure 4: <http://dx.doi.org/10.2308/JOGNA-2021-004.s01>

## IV. CASE LEARNING OBJECTIVES AND IMPLEMENTATION GUIDANCE

The instructor's guide describes the purpose of the case, learning objectives, and implementation guidelines including student guides. It also provides evidence of classroom validation. Provided separately are two Tableau packaged workbooks that contain the solutions to both parts of the case. The solution to Part I, the ETL part of the case, is also the template for Part II, the data visualization part of the case.

### Purpose of the Case

The purpose of the case is to increase awareness of data analytics and to expose students to a variety of data analytics skills necessary to enter the workforce given the changing nature of work in the accounting profession. PricewaterhouseCoopers (PwC) states that the ideal candidate for both tax and audit roles should develop specific technology skills such as data wrangling, data analytics, and data visualization (PwC 2018, p. 2). In addition, in its data-driven paper on what students need to succeed in a rapidly changing world, PwC recommends that accounting programs task students to solve real or instructor-developed business issues using data analytics with a primary focus “on communicating the results of analysis in an understandable way, such as through data visualizations” (PwC 2015, p. 16).

The activities in this case include all aspects of these recommendations. It also meets the definition of data analysis, which is defined as the “process of inspecting, cleaning, transforming, and modeling Big Data to discover and communicate useful information and patterns, suggest conclusions, and support decision making” (Cao et al. 2015).

The first part of the case centers specifically on the ETL process—a fundamental component of data analytics. The main goal of the ETL process is to extract data from multiple sources (E), clean and transform the data (T), and load the data into a single target application (L). For this case, the target application is Tableau Desktop, a leading data visualization tool. Typically, the data transformation part of ETL is the most challenging and time-consuming part of the entire project. The data transformation that takes place involves various operations, such as filtering, sorting, aggregating, changing data characteristics, removing duplicates, creating calculated fields, joining, and validating the data. Because Tableau Desktop is powerful enough to transform the data efficiently, most of the data transformation in this case is completed in Tableau Desktop, the target application that is used to complete the data analysis. Thus, this case uses the ELT approach rather than the ETL approach. That is, students will extract, load, and *then* transform the data.

The second part of the case instructs students to complete various types of data visualizations from a variance analysis to interactive pie charts. Students also create a dashboard for users to analyze the data on various partitions of the agency spending from dimensions that include program activities and object classes to individual general ledger accounts based on the desired view.

This case also responds to PwC's call for students to “develop a basic understanding of emerging technologies, including how they can be used to solve business issues in *industry-specific scenarios*,” (PwC 2018, p. 1; emphasis added). This case specifically introduces students to the DATA Act and to federal agency reporting while also increasing their understanding of data wrangling and data visualization techniques.

## **CASE LEARNING OBJECTIVES**

The DATA Act Dashboard case is a comprehensive series of activities that include background readings and hands-on experience wrangling and analyzing Big Data. The primary objective of the case is to introduce more advanced data visualization skills and learn to extract, transform, and load data into a downstream application used for analysis. This case also provides students with an opportunity to learn about and to analyze federal agency spending using a live data source.

Students who satisfactorily complete all parts of the case will be able to meet the following learning objectives:

1. Increase awareness of the Digital Accountability and Transparency Act of 2014 and the Chief Financial Officer's Act of 1990.
2. Understand how technology is impacting government agencies.
3. Extract data from multiple sources including scraping data from PDFs.
4. Load data into a Tableau database and create joins to connect various data sources.
5. Transform and manage data to include cleansing, creating calculations, and writing code to design parameters.
6. Apply critical thinking skills.
7. Become more proficient in data visualization techniques.

## **Intended Audience**

This case can effectively be implemented by multiple faculty. It is designed to be flexible based on instructor preferences. The case can be used in various courses including government accounting, accounting analytics, and auditing as described below. We created the case in multiple parts, enabling instructors to distribute only the content required for the course. The case can be used as the only visualization assignment in a course or as one of many offered in an analytics course.

For a government accounting course, the readings and analysis will increase student knowledge of federal government reporting requirements. These students can skip the data heavy ETL portion of the case and dive right into the visualization of the data because a Tableau template with the ETL portion completed is provided to them.

For a data analytics course, the readings can be designed to focus more on the impact of emerging technologies on the accounting and financial management professions and less on government reporting requirements. Students in a data analytics course should complete both the ETL and visualization parts of the case.

For an auditing course, the readings can help students learn about the Inspector General's Office and the role of internal and external auditing in the federal government. Questions for the case can focus more on the reprogramming or reallocation of funds based on discovery using the analytical tools in the case.

The following are the average times students spent completing each part of the case.

- Readings: 2 to 3 hours
- Part I of the case (ETL): 2 to 3 hours
- Part II of the case (Data Visualization): 1 1/2 to 2 hours

## **Implementation Guidance**

Prior to implementing the case, instructors should provide instructions for students to request a free one-year Tableau Desktop license as detailed in Appendix B of this instructor guide.

Appendix B also includes instructions to obtain the license for instructors. In addition, students should be asked to become familiar with some data visualization tools and terminology prior to completing the case. If the students are new to Tableau, students should complete the first part of the “Getting Started” tutorial created by Tableau to ensure that all students have basic Tableau skills (see link provided below). This will take students about an hour if they have no experience using data visualization tools. The students will also be happy to learn how easy Tableau is to use. Students only need to complete Steps 1, 2, and 5 to prepare for the case, but they would enjoy Step 3 on creating geographical data, which doesn’t take long to complete.

- Tutorial: Get Started with Tableau Desktop—Tableau ([Tableau Software LLC 2021](#))

Students will learn to do the following tasks from Tableau’s online basic training:

- Connect to data
- Drag and drop to take a first look
- Focus the results
- Explore the data geographically (optional)
- Drill down into the details
- Build a dashboard to show the insights

While the basic training available from Tableau is sufficient to learn the fundamentals, Cunningham and Stein list other Tableau tutorials and recommend using “Tableau 10 Essential Training” available on LinkedIn Learning ([Cunningham and Stein 2018](#)). Other sources listed in the article include online training videos available at HUB for Analytics Education at <http://www.hubae.org/tableausoftware> ([HUB of Analytics Education 2021](#)), and Chapter 4 from the [Richardson et al. \(2021\)](#) text, *Data Analytics in Accounting*. We do not use these sources. We have created additional exercises to hone-in on specific advanced skills and use the resources available in the academic resource portals of the Big 4 accounting firms.

### Suggested Readings

Instructors are encouraged to use current articles to reinforce the importance of technology and analytics in accounting similar to the following readings related to accounting in general (items 1 and 2) and for a government accounting course (items 3 and 4).

1. Monterio, B. 2019. The future of technology and analytics. *Strategic Finance* 100 (12): 76–77. ([Monterio 2019](#))
2. PricewaterhouseCoopers (PwC). 2018. *Developing Digital Acumen*. Fall 2018. PwC University Relations. ([PwC 2018](#))
3. Glenn, D., J. Hill, and M. Wetklow. 2019. The ABCDs of technology and impacts on federal financial management. *Journal of Government Financial Management* 67 (4): 42–47.<sup>3</sup> ([Glenn, Hill, and Wetklow 2019](#))
4. Longley, R. 2020. About the U.S. inspectors general: The U.S. government’s built-in watchdogs. *Thought Co.* (December 5). Available at: <https://www.thoughtco.com/about-the-office-of-inspector-general-3322191> ([Longley 2020](#))

### Suggested Case Questions

The body of the case is purposely written without required questions to allow the case to be used in a variety of courses. Instructors may choose the following suggested question categories

<sup>3</sup> This article is included in the background readings of the case.

and additional requirements depending on the course topic and course objectives. For those courses without a heavy data focus, a Tableau workbook with the data source already loaded and cleansed is provided so that only the data visualization part of the case can be assigned. For a data analytics course, both parts of the case can be assigned with instructions on extracting, transforming, and loading the data provided to the students.

- Questions related to the analysis in terms of variances and recommendations for reprogramming or reallocating funding based on trends observed.
- Questions for a Government Accounting course can include ones related to the DATA Act and the CFO Act, the standard general ledger, and spending dimensions (program activity, object classification, etc.).
- Questions for a Data Analytics course can relate to the ETL portion of the case and ask students to come up with additional solutions to improve on data integrity.

### Step-by-Step Instructions

Students are not required to have advanced skills in data analytics and data visualization to complete this case. Step-by-step instructions are provided as downloadable files in Appendix C to assist in upskilling students. These include the following:

- Student Guide: Extract, Transform, and Load
- Student Guide: Data Visualization

The case can be assigned in an asynchronously delivered course or one that meets in person, either during class or as a stand-alone assignment. Students in the asynchronous course can complete the case without instructor involvement using the detailed instructions provided in the student guides. Even when instruction is provided in class, students will be more comfortable using the detailed guides to follow along with during the class instruction.

The student guides are based on using Tableau Desktop software as the visualization tool. While the case is designed to allow the use of any of the many products offered, we chose Tableau Desktop because it is available to instructors and students free of charge. Further, free training videos and other resources are available. Tableau Desktop is used by many accounting firms, and PC Magazine chose Tableau Desktop and Microsoft Power BI as the best data visualization tools of 2019 (Baker 2019). Tableau's competitor, Microsoft Power BI, is limited in that the desktop version can only be used on a Windows operating system and universities must pay for student licenses.

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### Classroom Validation (Effectiveness and Feedback)

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The case has been used in both graduate and undergraduate accounting courses and at three teaching workshops with accounting faculty as detailed in Table 1. We piloted the case to two teaching assistants. One was a graduate student in the MSA Program. The other was an undergraduate student majoring in accounting. The first presentation of the case was at a hands-on pre-conference workshop at the 2019 AAA Annual Meeting. Participants of the workshop were faculty in the Government and Nonprofit Section of the AAA. Two other teaching workshops were offered in September and December of 2019. The teaching workshop participants completed only Part II of the DATA Act visualization case and not the ETL part because of time constraints.<sup>4</sup> The

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<sup>4</sup> Participants at the 2019 AAA Annual Meeting also completed the RPA companion case after completing the visualization case. Surveys for each case were administered separately.

**TABLE 1**  
**Participants**

<b>Year</b>	<b>Month</b>	<b>Description</b>	<b>Participants</b>
2019	August	Teaching Assistants Pilot	2
2019	August	AAA Annual Meeting	10
2019	September	Graduate Accounting Analytics Course	18
2019	September	Faculty Workshop	13
2019	December	Faculty Workshop	9
2020	September	Undergraduate Accounting Analytics Course	12
2021	January	Graduate Accounting Analytics Course	27

accounting faculty at the workshops had little or no experience working with Tableau prior to the workshops, although they were asked to and did complete the Tableau tutorial prior to attending the workshops. Students in both the undergraduate and graduate courses completed both the ETL and visualization parts of the case. Prior to the course in which the students were assigned the case, they completed a course on database management theory and enterprise systems. The students were also exposed to data visualization in that course where they completed both the Tableau tutorial and a case developed by Johan Perols, University of San Diego, and Marc Tomlinson, Deloitte & Touche LLP (Perols and Tomlinson 2016). In all, there were 32 faculty participants, 46 graduate students, and 13 undergraduate students who completed the case.

Pre-assessment surveys were collected prior to implementing the case asking participants questions related to their interest in analytics and in government reporting as well as their familiarity with these topics. Post-assessment surveys were collected after completing the case asking participants questions related to the quality of the case and whether the case increased their familiarity with data visualization tools and the DATA Act. All participants enjoyed working on the case and expressed feeling more confident using these technologies.

Pre-case survey responses are reported in Table 2. Participants were asked to rate both their knowledge of subjects described in the table and their interest in data analytics, the DATA Act, and data visualization tools. The knowledge questions related to database theory, macros, and coding are included only to illustrate that students do not need to possess these skills to complete and appreciate the case, even though students apply these skills in the case (scores are low and below average for these questions).

Most participants, including faculty, had little knowledge of the DATA Act and average to low knowledge of data visualization tools. Recall that participants were required to complete the Tableau tutorial prior to starting the case and completing this survey. Interest in data analytics and data visualization tools was medium high to high. Given that the participants were not enrolled in a government accounting course and only some faculty taught the course, the interest in the DATA Act was no more than average.

Table 3 presents the results of the post-case survey. All participants reported an increased knowledge and increased interest in data visualization tools. Only a modest increase in knowledge of the DATA Act is observed. We did not require the workshop participants to read the background on the DATA Act and only required the students to skim the articles. Most were not students or faculty in a government accounting course. Importantly, increased interest in the Data Act, however, was observed after completing the case. Discussions with faculty and students after the case concluded indicated that many planned to learn more about the Act and the data available.

**TABLE 2**  
**Summary of Feedback on Pre-Case Survey<sup>a,b</sup>**

	<u>All</u>	<u>Faculty</u>	<u>M.S.A. Students</u>	<u>Undergrad Students</u>
Knowledge Questions				
1 Relational database management theory	2.39 (1.17)	1.97 (1.22)	2.70 (1.12)	2.25 (0.87)
2 Querying relational databases	2.57 (1.18)	2.32 (1.40)	2.62 (1.07)	3.00 (0.85)
3 Data visualization tools such as Tableau	2.27 (1.01)	1.87 (0.85)	2.47 (1.08)	2.50 (0.90)
4 DATA Act and governmental reporting	1.43 (0.77)	1.32 (0.87)	1.52 (0.75)	1.33 (0.49)
5 Macros	2.17 (1.08)	2.23 (0.96)	2.09 (1.18)	2.33 (1.07)
6 Coding, e.g., VBA or Python	1.87 (1.05)	2.26 (1.18)	1.78 (0.96)	1.17 (0.39)
Interest Questions				
7 Data analytics	3.97 (1.05)	4.23 (0.76)	3.83 (1.15)	3.83 (1.27)
8 DATA Act and governmental reporting	2.83 (1.14)	3.10 (1.25)	2.64 (1.09)	2.92 (1.00)
9 Data visualization tools such as Tableau	3.92 (1.09)	3.94 (1.03)	3.83 (1.13)	4.25 (1.14)

<sup>a</sup> Survey scale was 1 to 5 where 1 was “low” and 5 was “high.”

<sup>b</sup> Means are presented in the table with standard deviations in parentheses.

All participants agreed (or strongly agreed) that the case was interesting and improved their confidence in using data visualization tools and that the case instructions were clear. All participants also recommended (or strongly recommended) that the case be used in other classes.

The evidence collected through the surveys suggest that the case is an effective instructional method to advance data analytics and visualization skills and sparked interest in federal government reporting.

## TEACHING NOTES AND STUDENT VERSION OF THE CASE

Teaching Notes and the Student Version of the Case are available only to non-student-member subscribers to the *Journal of Governmental & Nonprofit Accounting* through the American Accounting Association’s electronic publications system at <https://meridian.allenpress.com/aaa/>. Non-student-member subscribers should use their usernames and passwords for entry into the system where the Teaching Notes can be reviewed and printed. The “Student Version of the Case” is available as a supplemental file that is posted with the Teaching Notes. Please do not make the Teaching Notes available to students or post them on websites.

If you are a non-student-member of AAA with a subscription to the *Journal of Governmental & Nonprofit Accounting* and have any trouble accessing this material, then please contact the AAA headquarters office at [info@aaahq.org](mailto:info@aaahq.org) or (941) 921-7747.



**TABLE 3**  
**Summary of Feedback on Post-Case Survey<sup>b</sup>**

	All	Faculty	M.S.A. Students	Undergrad Students
Knowledge Questions <sup>a</sup>				
1 Data visualization tools such as Tableau	3.207 (0.871)	3.034 (0.865)	3.310 (0.869)	3.273 (0.905)
2 Digital Accountability and Transparency Act	2.598 (1.087)	2.172 (1.037)	2.857 (1.049)	2.727 (1.104)
Interest Questions <sup>a</sup>				
3 DATA Act and governmental reporting	3.122 (1.211)	3.069 (1.307)	3.143 (1.072)	3.182 (1.537)
4 Data visualization tools such as Tableau	4.207 (0.913)	4.172 (0.928)	4.238 (0.878)	4.182 (1.079)
Case Feedback <sup>c</sup>				
5 The instructions were clear	4.512 (0.653)	4.552 (0.632)	4.381 (0.697)	4.909 (0.302)
6 The case was interesting	4.366 (0.809)	4.448 (0.783)	4.310 (0.780)	4.364 (1.027)
7 The background information was sufficient	4.346 (0.710)	4.500 (0.638)	4.262 (0.767)	4.273 (0.647)
8 The case improved my confidence in using data visualization tools	4.354 (0.791)	4.448 (0.870)	4.286 (0.805)	4.364 (0.505)
9 I would recommend this case to be used in other classes	4.475 (0.711)	4.586 (0.733)	4.375 (0.740)	4.545 (0.522)

<sup>a</sup> Survey scale was 1 to 5 where 1 was “low” and 5 was “high.”

<sup>b</sup> Means are presented in the table with standard deviations in parentheses.

<sup>c</sup> Survey scale for the case feedback was 1 to 5 where 1 was “strongly disagree” and 5 was “strongly agree.”

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## APPENDIX B

### How to Obtain a Tableau License

#### Instructor Instructions

To request a one-year Tableau Desktop license and install the software on your computer, follow the instructions provided below. If you already have Tableau on your computer, you should download the latest version to your computer and use the product key given to you previously to activate the license.

- Go to the Tableau for Teaching site: <https://www.tableau.com/academic/teaching>
- Select the “Request Individual License” button and fill out the form.
- You should receive your key in a few hours once the form is submitted and Tableau verifies that you are an instructor at a university.

#### Student Instructions

To request a one-year Tableau Desktop license or to renew one that has expired, follow the instructions provided below. If you already have Tableau on your computer, you should download the latest version to your laptop.

- Go to the Tableau for Students site: <https://www.tableau.com/academic/students>
- Select the “Get Tableau for Free” button and fill out the form.
- You should receive your key in a few hours once the form is submitted and Tableau verifies you are a student at a university.

Need help installing the software? Answers to frequently asked questions are available at: <https://community.tableau.com/s/news/a0A4T000002O0vLUAS/tableau-for-students-faqs>. Note that the most recent versions of Tableau are only available for computers with 64-bit operating systems. If your computer is older, you can download the 32-bit version.

## APPENDIX C

- JOGNA-2021-004\_Student Guide Part I: <https://dx.doi.org/10.2308/JOGNA-2021-004.s02>  
JOGNA-2021-004\_Student Guide Part II: <https://dx.doi.org/10.2308/JOGNA-2021-004.s03>