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# Using Microsoft Excel to Enhance a General Education Economics Course

General education economics courses like "Survey of Economics" or "Principles of Economics" are notoriously difficult environments for fostering student engagement and retaining student interest. From the standpoint of students, the value-add of economics as a field, and frameworks for economic thinking may not be obvious, nor will the connections between economic theory and the world outside the classroom be apparent. This work outlines a simple exercise to incorporate into general education economics courses that nurture student engagement and expose students to basic spreadsheet applications such as Microsoft Excel for data manipulation, generation, visualization, and description. This exercise is designed to be conducted like a "lab" with explicit instructions and an in-class tutorial. The data students are provided and end results should relate course content to real-world phenomena, enabling students to see the value between the course material and its application outside of the classroom.

**Corey J.M. Williams**[†]

†Shippensburg University

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## 1. Introduction

Part of what economists do regularly is look at and analyze economic data. Understanding how to read, manipulate, and interpret [economic] data is of paramount importance for research, policymaking, and evaluation of current economic events (such as recessions). One thing that economists and other professionals who work in business administration, statistics, and engineering do regularly is look at and evaluate data. Knowing how to work with simple, and complex data sets is imperative for professional success in an ever-expanding digital environment.

For a general education curriculum, survey-type courses should aim to expose students to the basic foundational concepts of economic principles, while providing additional practical value that can be drawn upon for courses in a student's major curriculum and utilized to supplement critical thinking in a professional environment. Generally, survey courses succeed at providing students with a broad-strokes overview and understanding of both microeconomic and macroeconomic theory but fall flat on providing practical value to students once the class is completed.

This work serves as a proof-of-concept for using Microsoft Excel in combination with in-class tutorials to reinforce basic economics principles, while also introducing students to a valuable program that will serve them well for the remainder of their collegiate education and potentially in the workforce, too.

## 2. Related Literature

One of the most relevant pieces of related literature is that of Barreto (2015) who reviews the pedagogical value of spreadsheet applications as a learning tool in economics curricula. Barreto (2015) champions the value-add that spreadsheet applications provide to students by reinforcing economic theory while balancing the software rigor that is most appropriate for students. For a principles-level class or survey course, the author notes that the struggle with software applications is balancing the fundamentals of the course with the rigor of the technical tool or application. As such, there is an expression of some normative notions that utilizing Excel *could* risk tilting an economics course closer to a software-oriented course. While the author acknowledges this risk, their findings and survey of spreadsheet applications as tools tend to justify Excel as the most appropriate spreadsheet tool to augment an economics course. As such, we concur with in the author's findings and frame the exercise through Excel as the primary medium by comparison to other suites or tools.

Turning more towards similar exercise designs, Mixon and Tohamy (2001) present a series of brief examples illustrating how classic textbook graphs, illustrations, and concepts in economics can be replicated and made more flexible within an Excel workbook. The authors explicitly recreate three textbook graphs and concepts using an interactive Excel workbook as a proof-of-concept for how instructors can leverage Excel as a flexible instrument that simulates textbook chapters while allowing for more interactivity and instructor discretion for curricula design beyond what textbooks can provide given their rigidity. A key contribution of this work is a note that Excel and its flexibility allow students to provide feedback that can more readily be incorporated into future course construction than traditional prepackaged supplemental material that textbooks and/or textbook publishers traditionally allow for.

From a more experimental standpoint, Cagle et al. (2010) explore the pedagogical potential of spreadsheet applications in a finance course through an experiment wherein two instructors of the same introductory finance course use spreadsheet applications to support

their course curricula, while a third instructor of the same course does not utilize spreadsheet tools. When testing concepts that can be covered in spreadsheet applications in addition to conventional means, students with exposure to spreadsheet tools tended to fare better from a performance standpoint. This experiment is one of many encouraging pieces evaluating the efficacy of spreadsheet applications as a tool for course instruction and learning and motivates this work as well. We do, however, stress that the motivation for this spreadsheet application is to provide survey or principles students an opportunity to learn a new and marketable technical skill with economics as a convenient setting, while reinforcing otherwise tedious economic concepts.

Most recently, Decker and Bredthauer (2024) present work in a similar vein to our efforts with an Excel-driven data exercise oriented towards principles-level students. However, this exercise is much more intricate and contextualized than what is offered here, which is a more general orientation of working with a raw data file to produce descriptive statistics and an empirical demand curve largely from scratch. Decker and Bredthauer (2024) is more contextualized in that it aims to introduce students to a toy supply and demand framework through supply chain linkages in the beef industry. Rather than work with raw data at the outset, the authors present a tailor-made model spreadsheet with pre-built equations and functions within which students may change model parameters to observe supply and demand shifts through a connected supply chain during Covid-19 (much like www.desmos.com).

This exercise is incredibly valuable for illustrating shifts in supply and demand, however, its orientation is much narrower, as it does not explicitly teach Excel and its native functions to students per se, rather Excel serves as a medium to teach concepts related to supply and demand. This paper is more oriented towards using demand as a setting to teach Excel as a broader tool to a principles-level audience. Ideally, a combination of both Decker and Bredthauer (2024) and our work herein sufficiently teaches both Excel fundamentals and supply and demand.

A final significant effort within the literature to integrate both the utility of Excel with principles-level economic course instruction is that of Tipoe and Becker (2019), which is available at https://www.core-econ.org/doing-economics/index.html alongside instructor supplemental material. The most obvious intersection between our proposed exercise and *Doing Economics*' is their chapter seven section on supply and demand. The authors' chapter does have some similarities to our exercise in that their data looks at one commodity measured at different points in time.

However, their data is not in raw units, but in logs, thus, a requirement of the authors' exercise is to take the anti-log of their data to return its natural units. Furthermore, the authors provide students with supply and demand equations that are applied in Excel through its formula capabilities to produce a distribution of prices across all quantities in the data. This is slightly different from what we ask of students, wherein the students themselves use Excel's graphing utility to create a regression trendline from aggregated data via the Pivot Table functionality and "estimate" the inverse demand equation from the raw data in question.

## 3. Learning Objectives

With the existing literature in mind, the goals of this representative assignment are twofold:

- Provide students an opportunity to work with real-world data using Microsoft Excel in a lab-like environment.
- Reinforce the economic concept of **demand** and the **law of demand** by constructing

a demand curve with publicly available sales data.

Related to the first objective, in the context of a general education (non-major requirement) economics course, students will enter the class with considerable heterogeneity and preconceptions of economics as a field. Existing research suggests these preconceptions can lead to vastly different performance outcomes within introductory economics courses themselves (Happ et al., 2018). Of these preconceptions, supply and demand tend to be the foremost concept that introductory economics courses are anchored around. Thus, the use of Excel and data to anchor core economics concepts can, in turn, rectify some differences in individual preconceptions. Secondly, common microeconomics textbooks, ranging from the free Shapiro (2022) *OpenStax eBook* to the classic Mankiw et al. (2020) *Principles of Microeconomics* present supply and demand as a purely analytical framework, which can be abstract at times for students to grasp.

Utilizing Excel as a tool to teach and reinforce this concept adds considerable value to course execution. At a minimum, students learn a new tool (Excel) that can be used in many other courses and professional settings. Early exposure to programs like Excel potentially instills a long-run benefit of general education economics courses beyond core concepts. The integration of technology like Excel into economics education provides considerable value-add to the student experience by providing new skills and giving them a safe space to develop an aptitude for spreadsheet software. Specifically, in this short assignment, students will learn how to perform the following tasks in Excel:

- Calculate basic descriptive statistics, including mean, minimum, maximum, and sample standard deviation using built-in Excel formulas.
- Create a new column of data by multiplying elements of two existing columns together.
- Aggregating data by using the "Pivot Table" function.
- Plotting, labeling, and interpreting visual information from aggregated data.

While this example is contextualized within the economics concept of demand, there are a myriad of ways to set up similar data exercises that can reinforce different concepts in the field and add to the skillset students can develop by utilizing programs like Excel with more precision and purpose (Ibrahim, 2009). In many ways, this work complements the efforts of Méndez-Carbajo (2017) and Méndez-Carbajo and Asarta (2020) who advocate for the utilization of the St. Louis Federal Reserve's economic database (FRED) as an economics teaching tool through data visualization and manipulation.

## 4. Simple Step-by-Step Tutorial

Students should be instructed to download both the document containing the exercise instructions and steps, as well as the corresponding .xlsx file containing the data itself from the class webpage or from the repository where the course materials are hosted.[1] For the purposes of this assignment, the goal is taking raw data on sales prices and sales quantity of trading cards scraped directly from www.tcgplayer.com—a storefront that provides publicly available sales history data—and manipulate the data to plot an empirical demand curve.

Students should be given some context on the data or a basic overview of how to

[1] Data is also available publicly from the following repository: https://www.coreyjmwilliams.com/teaching/teaching-data-repository. Data can be downloaded or opened in Google Sheets by clicking the button titled "Data Set 1" under the "Estimating Empirical Demand Curves" heading. A "worksheet" version of this assignment is available in Appendix A.

read a raw data file. A subheading such as "Data Overview" in the instructions document that precedes the steps in the assignment itself is useful for contextualizing how to read the data file, as well as how to read a given observation. Continuing with the example discussed herein, three pieces of data are provided:

- **Date**: indicates the date (day) the transaction (observation) is recorded
- **Quantity**: indicates the total quantity of the good (trading cards) sold in each transaction
- **Price**: indicates the per good (per card) price of each unit sold in each transaction

The data used for this assignment is pulled from TCGPlayer, an online marketplace for trading cards from various collectible card games (CCG). Specifically for this assignment, the data provided to students is sales history data (price, quantity) for the Magic: the Gathering trading card "Preordain" from the set "Commander: The Lord of the Rings: Tales of Middle-Earth." Daily sales data is gathered from August 7th, 2023 through August 25th, 2023.

At this point, it is worth pointing out to students that each observation is effectively a sale with a recorded unit price and quantity. Extracting one row (observation) of each dimension of the data captured and spelling out explicitly how one reads that observation is also helpful for guiding students as well. For example, the first observation of data in the example data set is:

**Table 1. A Single Observation of Raw Data**

| Date | Quantity | Price |
|---|---|---|
| 8/7/2023 | 4 | 0.43 |

Instructors should explain to students that this observation reads: "On August 7, 2023, four copies of the given trading card were sold at $0.43 per card."

Taking time to also go over how to read an Excel file before even manipulating data is of value to the students as well who may be seeing spreadsheet software for the first time. With the data contextualized, instructors should move into the step-by-step instructions for completion of the lab. Instructors will be asking students to do the following tasks in order while walking through the lab in real-time:

Step 1. With your raw data, please calculate, and report the following descriptive statistics:

a. The **average** quantity and price

b. The **minimum** quantity and price

c. The **maximum** quantity and price

d. The **standard deviation** of the quantity and price

Step 2. With the raw data, calculate the total revenue of each transaction, and report the same descriptive statistics used in "Step 1" for this newly constructed series. Please report these statistics

Step 3. With the original raw data (Date, Quantity, Price), construct a "Pivot Table" using the feature in Microsoft Excel, set the "Row" field to your "Date" data series, and set the "Values" field to include both your "Quantity" and "Price" data. Change the

"Value Field Setting" for your "Quantity" and "Price" data within the Pivot Table to be "Average" rather than "Count." Please take a screenshot or save an image of the newly created Pivot Table.

Step 4. With your price and quantity data from the Pivot Table, construct a scatter plot of the data using the average quantity data values as your x-axis and the average price data values as your y-axis. Clearly label your axes and using the "Add Chart Element" feature in the "Chart Design" tab in Excel, add a linear "Trendline" to your scatter plot. Save this scatter plot as an image

Step 5. Right-click on the trendline in your scatter plot and click on the "Format Trendline" option. Within this option, check the box titled "Display Equation on Chart." What is the equation ()?

Step 6. Answer the following questions based on your Pivot Table, and scatter plot:

a. What economic relationship is being described by the plot you just created? How do you know this is the case?
b. Based on the formula associated with your linear trend line, calculate the effect of a one-unit increase in quantity on the price

For the first step, it is advisable to set up an empty table and guide students that the objective is to use Excel's built-in formulas to "fill it out" with the necessary descriptive statistics. The result should look like the following:

**Table 2. Basic Descriptive Statistics**

| Variable | Average | Minimum | Maximum | Standard Deviation |
|---|---|---|---|---|
| Quantity | 2.15 | 1.00 | 8.00 | 1.54 |
| Price | 4.31 | 0.40 | 12.98 | 3.27 |

Students will learn in the process the following Excel functions: average(), min(), max(), and stdev.s(). As the instructor, it is valuable and imperative to explain what each of these functions is achieving conceptually and mathematically. This sort of exercise also highlights the use of Excel as a tool for teaching or reinforcing statistical concepts on top of economic theory (Warner & Meehan, 2001).

For the second step, the students will learn how to multiply two columns worth of data together () to create and label a new column of data. Instructors should show students the Excel formula necessary to complete this task and indicate how multiplication is achieved between two series of data using the "Shift + 8" combination on the keyboard, which produces a "*" symbol necessary for multiplication. After students correctly create this new variable, they should produce a new set of descriptive statistics as described below:

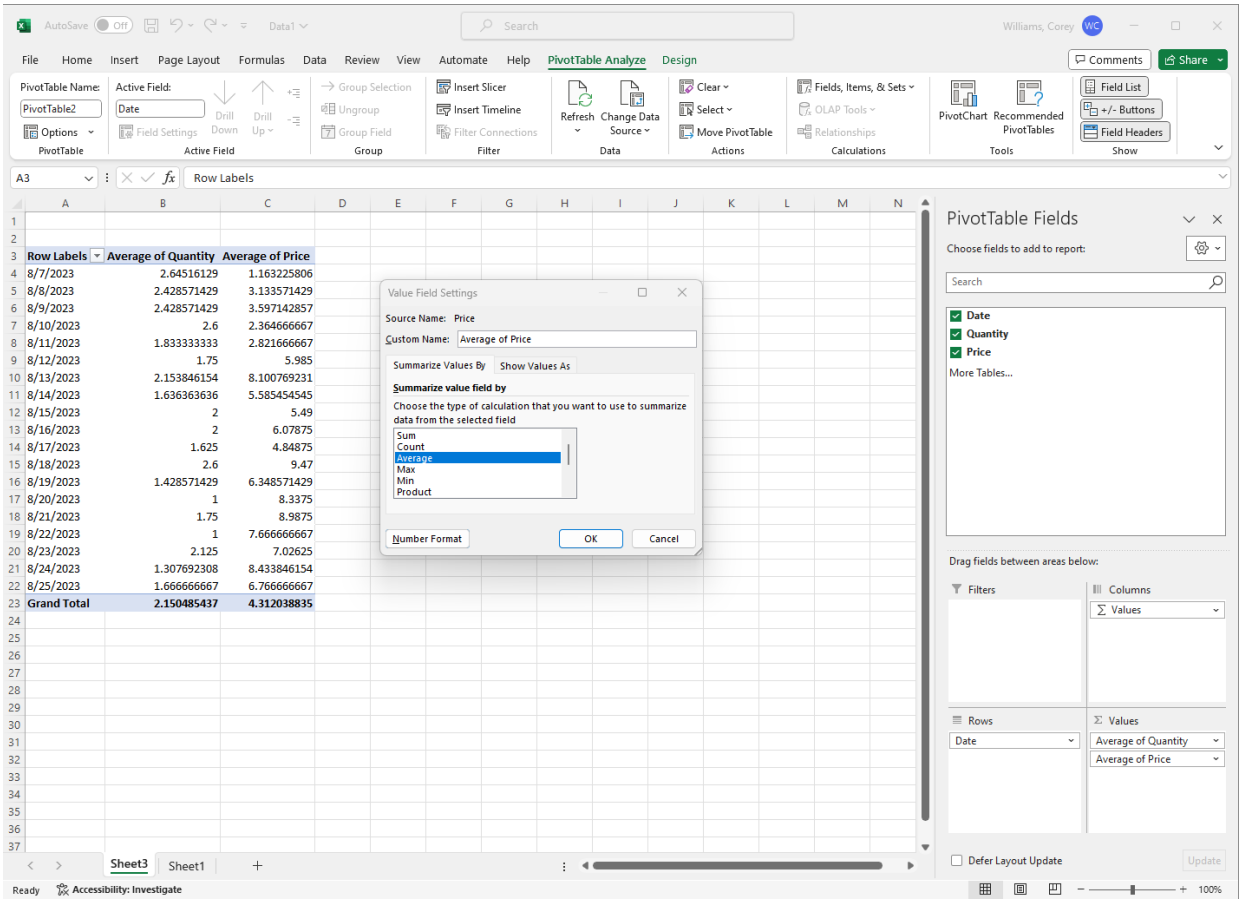
**Table 3. Expanded Descriptive Statistics**

| Variable | Average | Minimum | Maximum | Standard Deviation |
|---|---|---|---|---|
| Revenue | 7.95 | 0.40 | 43.92 | 8.01 |

The third step is the most complicated and likely will require the most time compared to the previous steps that use basic and intuitive Excel functions. The "Pivot Table" table functionality requires students to highlight the data columns they wish to "aggregate" using the flexible framework that Pivot Tables provide. After showing students how to select multiple data series at once, students should be guided to the "Insert" tab in the Excel tools ribbon,

wherein the Pivot Table button can be found.

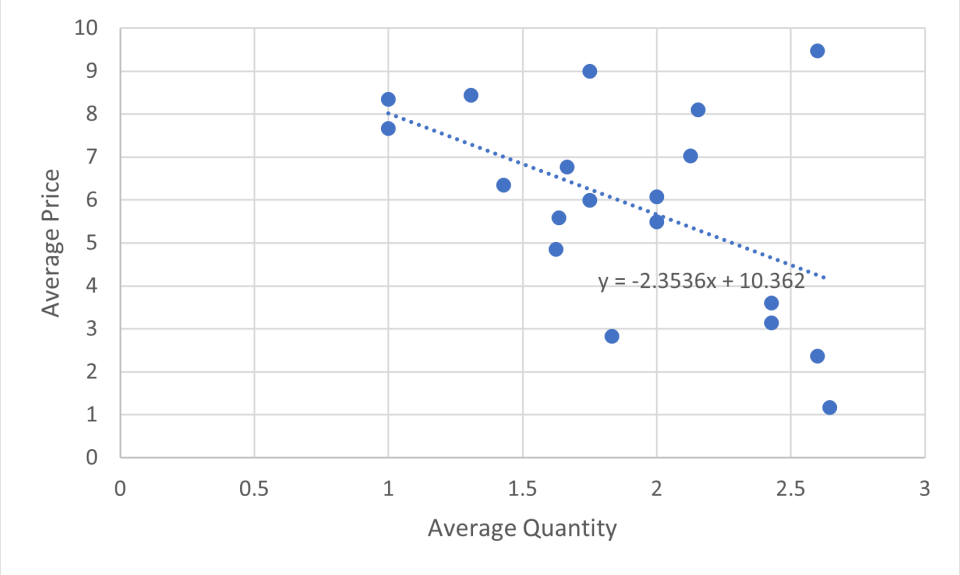
**Figure 1. Pivot Table Output**




For assisting students in interpreting the Pivot Table output, it is worth stressing that the newly created table will automatically show the average quantity of cards sold per transaction at an average price level at each date in time in the sample. Students should be told that is a form of data aggregation. Rather than observe all observations of raw data, we observe observations of average prices and quantities.

Once students have their Pivot Table completed, they can proceed with using their aggregated data to create a scatter plot of price against quantity as in Step 4. After formatting the scatter plot appropriately with the trendline, and trendline equation, students should be able to display the following figure:

**Figure 2. Scatterplot from Tutorial**




Students should be able to see that what they have constructed is an **empirical demand curve**. Explaining to students the nature of *empirical* versus *theoretical* will assist in expositing this result and its meaning from a practical standpoint. The formula implies that if the quantity demanded of this card increases by one unit, prices will fall by $2.35, roughly speaking, which correctly reflects the **law of demand**. It is worth noting that aggregating average demand over time differs slightly from how traditional economics textbooks characterize demand schedules, which are usually static levels of prices and corresponding quantities. We argue that this exception is appropriate for maintaining simplicity for the basic version of this tutorial. Beyond this, the highly regarded and still-relevant Working (1927) paper stresses that ontologically, "statistical" demand curves need to consider whether in equilibrium supply is more variable than demand, the market to which the price and quantity data is referred, the extent to which the ceteris paribus assumption holds true, and whether shifting supply and demand curves is correlated or random.

Unfortunately, we do not know the variability of supply of the card in question as its print-run is not explicitly stated by the parent company. For simplicity, we only observe sales data over a small interval for student and application ease of use; having said that, the demand for this card with extreme values removed is relatively stable. In the context of the market from which the data originates, we know we are observing secondary market sales, rather than primary market sales. Finally, while it is easy to assume ceteris paribus holds, we do not observe all other factors that *could* affect the secondary market for collectible cards, rather we observe secondary market transactions in a marketplace of many buyers and sellers.

For these reasons, "smoothing" quantity and price data temporally by taking their average serves to make the exercise for students more tractable by minimizing the presence of sporadic sales and other uncontrollable factors that may cause the empirical validity of the estimated demand curve to violate the law of the demand.

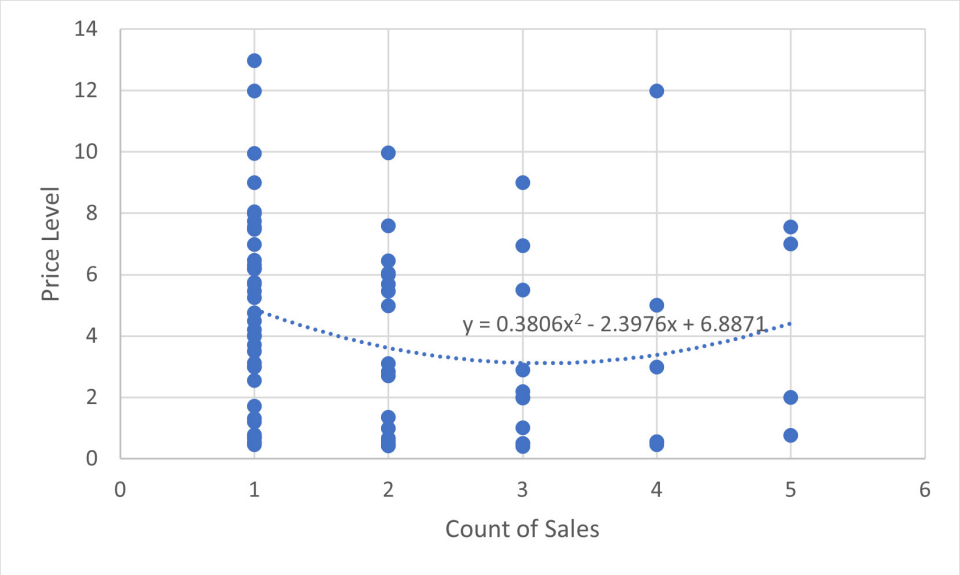
## 5. Tutorial Extension: Aggregating by the Price Level & Removing Outliers

While it may be less common to aggregate over time by an average price and average quantity, a more traditional approach can be taken to capturing empirical demand by aggregating each unique price level and the corresponding count of sales. To do so, students

should be instructed to construct a "Pivot Table" using just the "Quantity" and "Price" data. This alternative approach is largely the same as our original tutorial but with a small modification starting at "Step 3."

Students should make sure that the "Value Field Settings" for the "Quantity" data is set to "Count," rather than "Sum." This should produce a more conventional schedule of prices and quantities than one would expect when looking at a textbook demand curve. When recreating "Step 4" and "Step 5," students should be encouraged to experiment with fitting different types of trendlines. For simplicity, when students are instructed to use the "Add Chart Element" feature, and "Trendline" option, they should be pointed in the direction of "More Trendline Options," which brings up a separate menu where one can add a "Polynomial" trendline. Fitting a polynomial trendline captures the fact that there is a kink in the demand relationship around $5.50. Visually, this polynomial fit and the new demand curve is expressed as:

**Figure 3. Scatterplot from Tutorial with Polynomial Trendline**




This result along with the corresponding trendline formula may be confusing to some students, as it would appear the law of demand holds up to a price level of $5.50. Defining what a *kinked demand curve* is may help alleviate some confusion (Efroymson, 1943). This result also presents an opportunity to have a conversation with students on how data often mirrors theory *imperfectly*. Despite this, students should be able to see that the number of observations after the "kink" in the demand curve is sparse relatively speaking, thus the law of demand mostly holds across the bulk of observations in the data.

Depending on the preferences of the instructor, one could go a step further and illustrate how to remove outlying sales data. To do this in Excel, students need to know how to calculate the first quartile, third quartile, interquartile range (IQR), and the corresponding lower- and upper-bounds for identifying non-outlying data. Assuming the aggregated data using the "Pivot Table" function is intact, proceed to copy and paste the quantity and price data from the Pivot Table to two empty arrays in Excel, say column "E" for the "Count of Quantity" (sales) data, and column "F" for the "Price Level." In a separate column (say column "I"), instruct students to write out five labels for items that will be calculated from the aggregated data: "QTL 1" (quartile one), "QTL 3" (quartile three), "IQR" (interquartile range), "Lower," and "Upper."

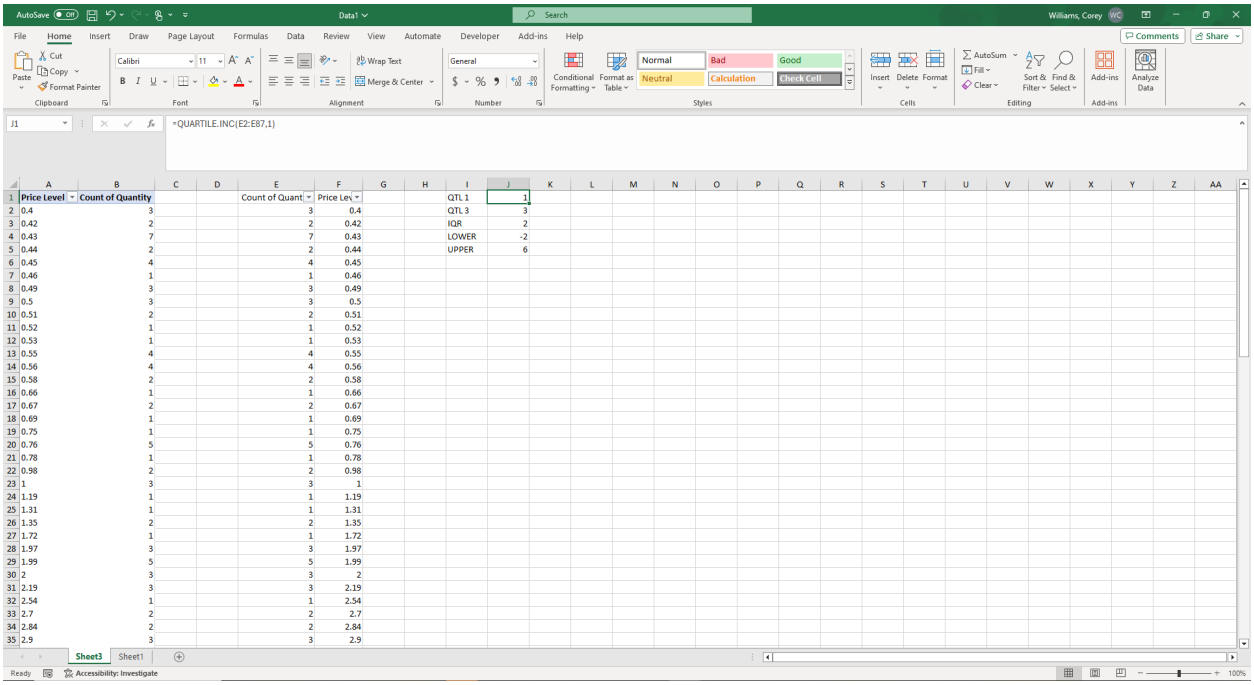
At this point, instructors should tell students we are going to identify outliers in the

data using the distributional qualities of the data. In the column directly next to our newly created labels, students should use the following formulas to identify the necessary quartiles, interquartile range, and the boundaries beyond which outliers are identified:

- =QUARTILE.INC(E2:E87,1)
- =QUARTILE.INC(E2:E87,3)
- =J2-J1
- =J1-1.5*J3
- =J2+1.5*J3

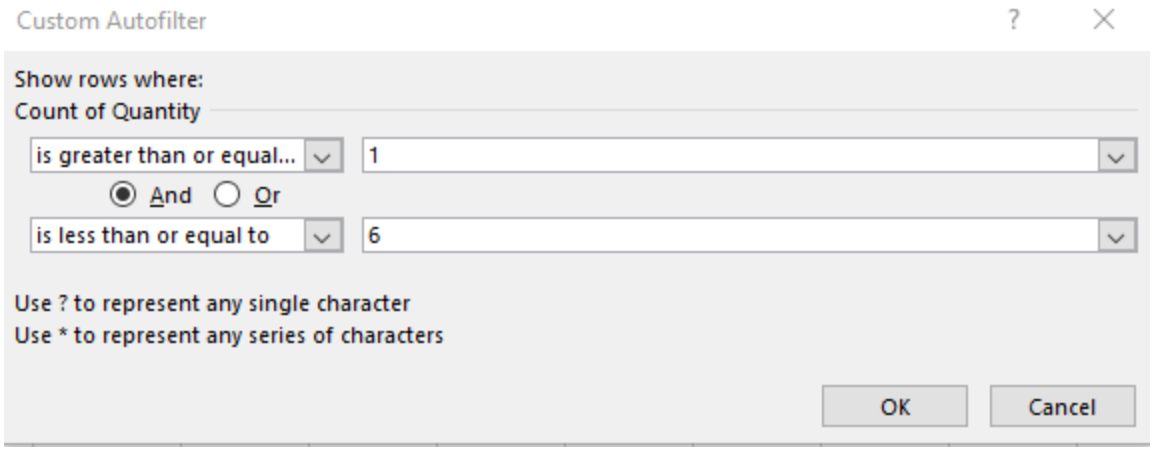
In turn, the first formula identifies the first quartile in the sales quantities, while the second formula identifies the third quartile. Assuming the column placement in the Excel workbook aligns with the column placement in the above instructions, the third formula expresses the interquartile range, while the fourth and fifth formulas express the respective lower and upper boundaries. Figure 4 shows an example of a workbook with the formulas in question applied per the instructions.

**Figure 4. Identifying Quartiles**



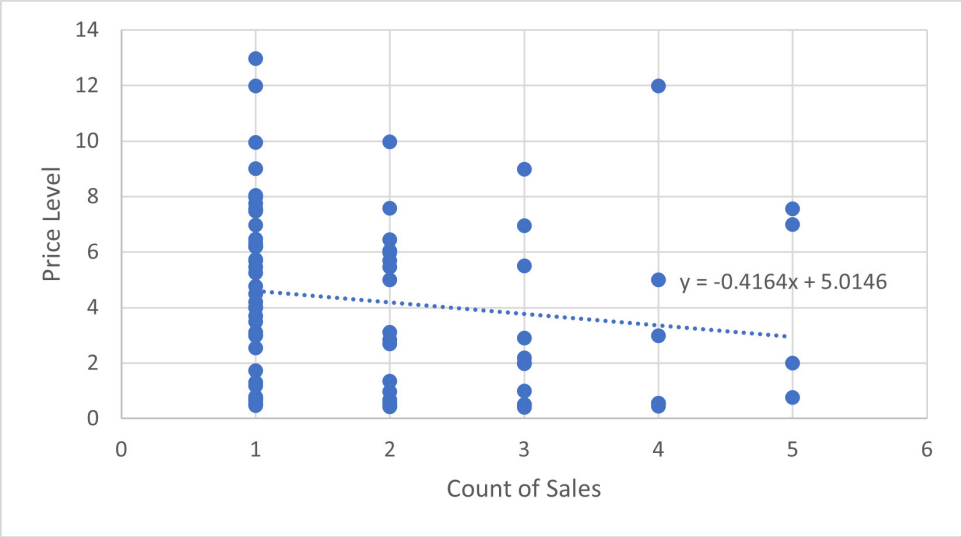

To "remove outliers," students should be instructed to select their "Count of Quantity" column as in Figure 4, and then go to the "Data" tab in Excel and click on the "Filter" function. This creates a dropdown arrow on the title of the quantity column. Using the "Number Filters" option when clicking on the dropdown arrow, students should be instructed to navigate to the "Custom Filter" option. This option will allow the user to filter data by more than one criterion. This is ideal, as we want to filter the data below the lower-bound (1), and above the upper-bound (6). Figure 5 shows how this advanced filter setting can be utilized to effectively remove outliers:

**Figure 5. Advanced Filter Options**




Time permitting and depending on the preferences of the instructor, the students could once more be directed to create a scatterplot with a linear trendline now that the outliers are removed. Figure 6 shows this result.

**Figure 6. Scatterplot from Tutorial without Outliers**




## 6. Additional Notes for Successful Implementation

Successful implementation of this tutorial (or similar tutorials) requires both time and patience. It is best to allocate an entire 50-minute class period, part of a 75-minute class period to go through this tutorial in its entirety. If an instructor's classroom does not have access to a projector screen or adequate technology to project the tutorial and go through it step-by-step, instructors should work with facilities to secure a computer lab or similar environment conducive to the technological requirements of this tutorial.

Furthermore, to be respectful of student financial constraints, it is also important to point out to students Microsoft Office product licenses that may be available through the university, as free student licensure can save students hundreds of dollars if they do not already have access to Excel on their personal computer. Beyond this, instructors should encourage students to utilize

free substitutes to Excel like OpenOffice, which has largely the same capabilities and formulas available as a typical Excel program. An additional consideration is that all the formulas utilized in this tutorial as well as the Pivot Table function, can be identically applied and replicated using Google Sheets, which is user-friendly and free of charge. Chart customization in Google Sheets, however, is slightly different from a user's perspective compared to Excel.[2]

A final consideration for students is making available a separate, asynchronous tutorial for students to reference after the lab period itself (this could be posted as a link to an unlisted YouTube video or a similar pre-recorded lecture nested within the course's digital homepage). This allows students who have steeper learning curves with the software to learn at their own pace outside of class before the deliverables of the assignment are due. While instructors can decide what the deliverables for such a data exercise or tutorial would be, an example of guidance for students in terms of what they must turn in and the weight of each deliverable would be as follows:

- A table of descriptive statistics calculated from Step 1 [20%]
- A table of descriptive statistics calculated from Step 2 [20%]
- A copy of the Pivot Table created from Step 3 [20%]
- A copy of the scatter plot created in Steps 4, and 5 [20%]
- An answer to the set of questions posted in Step 6 [20%]

## 7. Concluding Remarks

General education economics courses are a challenge to design and execute. For most students, survey-type economics courses will be their only exposure to economics in their undergraduate careers. To enhance student engagement and generate value-add for these courses, this paper outlines an effective opportunity to integrate Microsoft Excel, its capabilities, and real-world economic data into course curricula for general education economics courses.

A simple tutorial and instructional methods to maximize the value these data-oriented exercises have for students is offered in this paper. Beyond this, we show how the functionality of Excel or similar spreadsheet applications can be used to affirm otherwise abstract economics concepts for students, while simultaneously building a technical skillset that will serve them well in a professional setting, and other academic courses and endeavors.

[2] See Appendix B for notes on reproducing Figure 2 in Google Sheets.

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## Appendix A: Assignment Worksheet & Exercise Instructions

A compressed and concise "worksheet" form of the most basic version of this tutorial if offered. This worksheet is how the project would be assigned to students in tandem with the required data set. Instructors can modify this to fit their needs given the flexibility of the assignment as discussed.

**Data Exercise 1: Empirical Demand Curves**

*Survey of Economics*

**Name**:

**Date**:

**Possible Points**: 100

*Downloading the Data*

Download the "Data1.xlsx" Excel file from the "Assignments" page on the course homepage under the "Data Exercise 1" assignment tab.

*Data Overview*

The data used for this assignment is pulled from TCGPlayer, an online marketplace for trading cards from various collectible card games (CCG). Specifically for this assignment, the data provided to you is sales history data (price, quantity) for the Magic: the Gathering trading card Preordain from the set "Commander: The Lord of the Rings: Tales of Middle-Earth." Daily sales data is gathered from August 7th through August 25th, and contains three specific variables:

1. **Date**: indicates the date (day) the transaction took place
2. **Quantity**: indicates the total quantity of cards in each transaction
3. **Price**: indicates the per card price of each card in each transaction

All observations are, therefore, individual sales. For example, a single observation of data can be viewed as:

| Date | Quantity | Price |
|---|---|---|
| 8/7/2023 | 4 | 0.43 |

This observation is equivalent to a row in a Microsoft Excel file. The way we read this data is as follows:

*On August 7, 2023, four copies of "Preordain" were sold at $0.43 per card...*

For this data set, there are specifically 206 unique transactions captured over the time frame.

Instructions

Step 1. With your raw data, please calculate, and report the following descriptive statistics: the **average** quantity and price, the **minimum** quantity and price, the **maximum** quantity and price, and the **standard deviation of** the quantity and price

Step 2. With your raw data, calculate the total revenue of each transaction, and report the same descriptive statistics used in "Step (1)" for this newly constructed data series. Please report these statistics

Step 3. With your original raw data (Date, Quantity, Price), construct a "Pivot Table" using the feature in Microsoft Excel, set the "Row" field to your "Date" data series, and set the "Values" field to include both your "Quantity", and "Price" data. Change the "Value Field Setting" for your "Quantity" and "Price" data within the Pivot Table to be "Average," rather than "Count." Please take a screenshot or save an image of the newly created Pivot Table

Step 4. With your price and quantity data from your Pivot Table, construct a scatter plot of your data using the average quantity data values as your x-axis, and the average price data values as your y-axis. Clearly label your axes and using the "Add Chart Element" feature in the "Chart Design" tab in Excel, add a linear "Trendline" to your scatter plot. Save this scatter plot as an image

Step 5. Answer the following questions based on your Pivot Table, and scatter plot: *What economic relationship is being described by the plot you just made*? *Why*?

*Turning In Your Assignment*

For submission, please submit a Word document containing:

- The descriptive statistics you calculated from "Step (1)" [**20 Points**]
- The descriptive statistics you calculated from "Step (2)" [**20 Points**]
- A copy of the Pivot Table you created in "Step (3)" [**25 Points**]
- A copy of the scatter plot you created in "Step (4)" [**25 Points**]
- Typed responses to the questions posted in "Step (5)" [**10 Points**]

## Appendix B: Reproducing Figure 2 in Google Sheets

To recreate Figure 2 in Google Sheets, see the following steps:

1. Highlight all three columns of raw data
2. Go to the "Insert" option in the Google Sheets ribbon, and click the "Pivot Table" option, and create it in a new sheet
3. Using the "Pivot Table Editor" menu displayed on the right side of the new sheet:
    a. For the "Rows" field option, click the "Add" button and select your "Date" data
    b. For the "Values" field option, click the "Add" button and select both the "Quantity" and "Price" data
        i. For both "Values," change the "Summarize By" option from "SUM" to "AVERAGE." This will result in Figure 4
    c. Select the entire "Quantity" and "Price" columns of aggregated data from your Pivot Table, excluding the "Grand Total" row. While this data is selected, click "Insert" from the Google Sheets ribbon, and select the "Chart" option. This will create a line chart by default and automatically bring up the "Chart Editor" menu on the right side of the screen
    d. In the "Chart Editor" menu, select the "Chart Type" dropdown menu, and change the chart from a "Line Chart" to a "Scatter Chart"
    e. In the "Customize" sub-menu in the "Chart Editor" menu, scroll down to the "Series" field and click to reveal its options
        i. Check the "Trendline" box
            1. In the "Label" option dropdown that appears after selecting "Trendline," select the "Use Equation" option. This produces Figure 7, which precisely replicates Figure 2, but in Google Sheets

**Table 4. Google Sheets View of Pivot Table**

| *Date* | AVERAGE of Quantity | AVERAGE of Price |
|---|---|---|
| 8/7/2023 | 2.64516129 | 1.163225806 |
| 8/8/2023 | 2.428571429 | 3.133571429 |
| 8/9/2023 | 2.428571429 | 3.597142857 |
| 8/10/2023 | 2.6 | 2.364666667 |
| 8/11/2023 | 1.833333333 | 2.821666667 |
| 8/12/2023 | 1.75 | 5.985 |
| 8/13/2023 | 2.153846154 | 8.100769231 |
| 8/14/2023 | 1.636363636 | 5.585454545 |
| 8/15/2023 | 2 | 5.49 |
| 8/16/2023 | 2 | 6.07875 |
| 8/17/2023 | 1.625 | 4.84875 |
| 8/18/2023 | 2.6 | 9.47 |
| 8/19/2023 | 1.428571429 | 6.348571429 |
| 8/20/2023 | 1 | 8.3375 |
| 8/21/2023 | 1.75 | 8.9875 |
| 8/22/2023 | 1 | 7.666666667 |
| 8/23/2023 | 2.125 | 7.02625 |
| 8/24/2023 | 1.307692308 | 8.433846154 |
| 8/25/2023 | 1.666666667 | 6.77 |
| **Grand Total** | **2.150485437** | **4.312038835** |

Figure 7. Recreation of Figure 2 in Google Sheets