# TEACHING PRICE AND INCOME ELASTICITIES OF DEMAND USING EXCEL AND FEDERAL RESERVE ECONOMIC DATA

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**Abstract**

This paper describes an assignment designed for use in an undergraduate Principles of Economics course. The assignment is a pedagogical tool that encourages collaborative problem-solving and the use of recent up-to-date data from the Federal Reserve Economics Data (FRED) to compute and analyze the price and income elasticities of demand. This tool is an efficient way for undergraduate economics students to understand the price and income elasticity of demand, gain valuable experience using public datasets, and develop their computer skills without taking classes outside of the economics major.

Keywords: price elasticity of demand, FRED, EXCEL, active learning, collaborative problem-solving

JEL Classification: A20, A22, C82, D12

## Introduction

A discussion of elasticity is often introduced as a corollary to supply and demand analysis in the typical Principles of Economics class. In general, elasticity is a measure of the responsiveness of buyers and sellers to changes in price or income (Coppock and Mateer, 2014). Price elasticity is an important concept in economics, and the knowledge of elasticity has applications in both consumer and firm theory (Wei, 2013). For example, there is a direct relationship between price elasticity and consumer expenditure and total revenue. In addition, when examining the association between the price level and output using the aggregate demand/ aggregate supply model, or the price level and money supply using the quantity of theory money, elasticity stimulates the discussion of the short versus the long run. Because of its applications, the concept is arguably one of the most essential definitions students learn in introductory economics courses. Students are often introduced to price elasticity of demand, cross-price elasticity, income elasticity, and supply elasticity.

Despite its applications, instructors face several pedagogical challenges when introducing this topic, and principles textbooks are often criticized for confusing students (Andrews and Benzing, 2010). Instructors often struggle with student engagement and innovation to enhance student learning and assess the quality of understanding (Lodge et al., 2018). The use of artificial data by textbooks to help students compute the elasticity numbers without much success in promoting intuition and the application of elasticity has been a long-standing critique. As a result,

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elasticity is one of the more challenging concepts in economics courses as students struggle to grasp its real-life applications and may become less engaged (Slater, 2018).

This paper addresses the challenge of confusing and often unrelatable explanations of demand elasticity that use artificial data by instead employing a novel and easy to apply pedagogical tool: the "pre/post-in-class activity." This tool focuses on improving students' comprehension of price and income elasticity through reflection and collaborative learning with real-world data. By completing this activity, students form hypotheses regarding the economic theory of demand elasticity and check these predictions using recent, more relatable data. We recommend that students work in groups because collaboration enhances academic achievement, student attitudes, and student retention (Prince, 2004).

The activity can be administered in a Principles of Economics course to reinforce students' understanding of demand elasticity. The assignment is designed to take one to two hours of instructional time and may be best suited for labs where students work on their laptops, tablets, or computers. Specifically, the lesson requires students to compare their knowledge of concepts directly after the learning activity, which involves collecting data and analyzing the price and income elasticities of demand for popular consumer goods using Federal Reserve Economic Data (FRED) from January 2000 to December 2021.

The FRED was chosen because it is publicly available, widely used, and can be easily incorporated into the classroom. FRED was created and is maintained by the Federal Reserve Bank of St. Louis Research Department. It is an online platform that provides data from several international and domestic sources, such as the Bureau of Labor Statistics (BLS), Census, and Bureau of Economic Analysis (BEA). Additionally, it allows users to display data in tables or charts, and one can easily download data into spreadsheets. The FRED includes data on nearly 818,000 domestic and international variables over time.[3]

We focus on data from the last two decades in this assignment because this period includes a mix of economic expansions and recessions that fostered significant changes in consumer demand. Incorporating recent data in class activities is also supported by research showing that students are much more excited and can relate more quickly to current examples (Ghosh and Rahman, 2011; Mendez-Carbajo and Asarta, 2017). Using recent data also allows students to recall their unique demand response to the price and income changes discussed in the assignment. This connection with the data may lead to increased student engagement and discussion. Hence, by using this tool, the instructor can overcome some of the common challenges associated with student engagement in the classroom.

The assignment requires students to analyze the data using Microsoft Excel (hereafter, EXCEL). Consequently, it provides an opportunity for students to develop practical EXCEL skills that can be used in other courses as well as in their future careers. One advantage of using EXCEL in an introductory class is that minimal training is required. Specifically, there is no complex computer programming language to learn when using EXCEL. Additionally, most college-level students have some knowledge of essential EXCEL functions, so it should not take a lot of instructional time before students can apply the appropriate functions to calculate the desired concepts, i.e., price and income elasticities of demand.

Technology is an integral part of business and continues to evolve. Therefore, it is essential to equip students with the necessary skills to thrive in this changing technological environment. Formby et al. (2017) report that advanced analytical skills in EXCEL are associated with increased marketability and compensation for college graduates. Because graduates, particularly business

[3]For more information, please visit https://fredhelp.stlouisfed.org/fred/about/about-fred/what-is-fred/.

students, frequently use EXCEL in the workplace, students need to be exposed to the array of functions and capabilities in EXCEL. The assignment outlined in the current paper provides an opportunity for students to gain some of these skills.

In contrast to the traditional lecture, the proposed assignment uses collaborative learning where students work in small groups toward achieving a common goal. Allowing student interaction is important; as neuroscience research shows, we do not pay as much attention to things we find boring (Barreto, 2015). For example, in a class setting with a dominant speaker, students tend to listen and take notes instead of focusing entirely on that speaker. Listening, doing something with a computer, i.e., visualizing the data, getting the summary statistics, or using formulas, is one step better (Barreto, 2015; Bonwell, 1991). Research also outlines that using active learning techniques promotes mastery of the content and is superior to lectures (Bonwell, 1991). As instructors, we can achieve the goal of helping students to think like economists only if they get a better understanding of the economic concepts so that they use them in problem-solving and analysis (Salemi, 2002). Collaborative learning supported by the current lesson is superior to the traditional lecture.

Our proposed assignment contributes to the literature on teaching economics using active learning techniques and public datasets by integrating data analysis. Mendez-Carbajo and Asarta (2017), Mendez-Carbajo, Taylor, and Bayles (2017), and Suiter and Mendez-Carbajo (2018), Wolfe (2020) use FRED to teach specific topics of price elasticity of demand, Taylor rule, forecasting, and introductory level macroeconomics concepts, respectively. In addition, EXCEL is adopted by Briand and Hill (2013) to teach Monte Carlo simulations in econometrics and by Bongers et al. (2020) for the general equilibrium model. While sharing a similar pedagogical approach to this strand of teaching economics in higher education, our proposed pedagogical tool differs in the following ways: *(i)* integrates data analysis and group-based learning using "pre/post-in-class activity" assessments; *(ii)* utilizes current data, which allows students to discuss the change in price and income elasticities during two economic downturns; and *(iii)* encourages desired analytical skills such as creating and describing of line graphs and teaches students how to shade recessionary periods using EXCEL.

## The Great Recession and COVID-19 Pandemic

Knowledge of elasticity allows us to discuss "by how much" quantity demand and quantity supply change in response to an exogenous shock to price or income. Several papers (for example, Susskind and Vines, 2020, Lusk and McFadden, 2021, and Saksena et al., 2018) have discussed the effects of recent recessions (the Great Recession and the COVID-19 recession) on consumer demand. We focus on the size of this decline, its impact on prices and income, and whether their effects align with a priori expectations and economic theory. This analysis is expected to provide a student with a methodological way to unpack real-world observations, such as why the demand for services declined by more than the fall in demand for groceries.

Using data from 2000 to 2021 to calculate price and income elasticities of demand, we can highlight the impact of two economic crises students may have experienced in their lifetime: the Great Recession and the COVID-19 pandemic. The Great Recession began in December 2007 and ended in June 2009; it was the most prolonged economic downturn in many countries- including the United States, since the Great Depression (1929-1939). The economic crisis led to increased home mortgage foreclosures worldwide and caused millions of people to lose their savings, jobs, and homes. Ten years after the Great Recession, in late 2019, a pneumonia disease appeared in Wuhan, China, then spread globally, resulting in the pandemic known as COVID-19 (Zhu et al.,

2020). With the recommendation of the World Health Organization (WHO), on March 13, 2020, the United States declared a nationwide emergency. Following March 15, states began implementing shutdowns to prevent the spread of COVID-19 (CDC, 2022).

The Great Recession's impacts on consumer demand operated almost exclusively through changes in income and unemployment. In contrast, the COVID-19 implications for consumer spending include these channels and more, such as supply shocks (for example, regulations affected the supply of goods and services, and there were issues such as the temporary slowdown in meat processing due to worker illnesses) which resulted in significant changes to market price. Additionally, government support sanctioned by the Coronavirus Aid, Relief, and Economic Security (CARES) Act of 2020 caused aggregate personal income to increase (BEA, 2022).[4] Consequently, the COVID-19 pandemic-induced recession has different causes and features compared to the Great Recession. Nonetheless, they share the common part of changes in income, rising unemployment, and lower consumer demand. So, it is instructive to compare consumer demand response to price and income changes during these recent economic downturns.

Almost all Principles of Economics textbooks include a section on the factors/determinants that affect the price elasticity of demand. For example, price inelastic products are typically described as necessities with a few substitutes, and expenditure on these products often absorbs a small fraction of income. Conversely, elastic products tend to be luxuries, with many substitutes that cover a large proportion of income (Acemoglu et al., 2021; Hubbard and O'Brien, 2021; Bade and Parkin, 2021). To cement the understanding of the price elasticity of demand, students will plot the elasticity numbers they calculate; hence they can observe the impact of downturns in the economy on certain goods and services.

For students to better understand the price and income elasticity of demand, we carefully choose goods and services where there was a significant change in their consumption preferences and which are believed to be relatable. Data from the Bureau of Labor Statistics show that the largest changes in consumer spending during the pandemic were food away from home (FAFH), alcoholic beverages, apparel, and services (BLS, 2022). So, we analyze the price and income elasticity of demand for FAFH, alcoholic beverages, and electricity. A natural extension to the current assignment may include a discussion of price and income elasticities for garments and air transportation.

## In-Class Activity Assignment

This section discusses the in-class assignment in detail. The activity is designed to take one to two hours of instructional time.

### *Student learning outcomes*

At the end of this assignment, students should be able to:

1. Extract price, quantity, and income data from FRED
2. Calculate elasticity using EXCEL
3. Create graphs in EXCEL

[4] The 2020 recession may be described as unusual because aggressive government crisis relief payments and increases in unemployment benefits largely offset declines in aggregate income. The recession was very brief, lasting only two months and ending in April 2020. In the current paper, we use data from 2020 to 2021 to capture the effect of the COVID-19 pandemic on consumer demand. However, improvements in the economy post-April 2020 may offset the recessionary impact. This is a limitation of the annual data used in the current exercise.

4. Analyze data

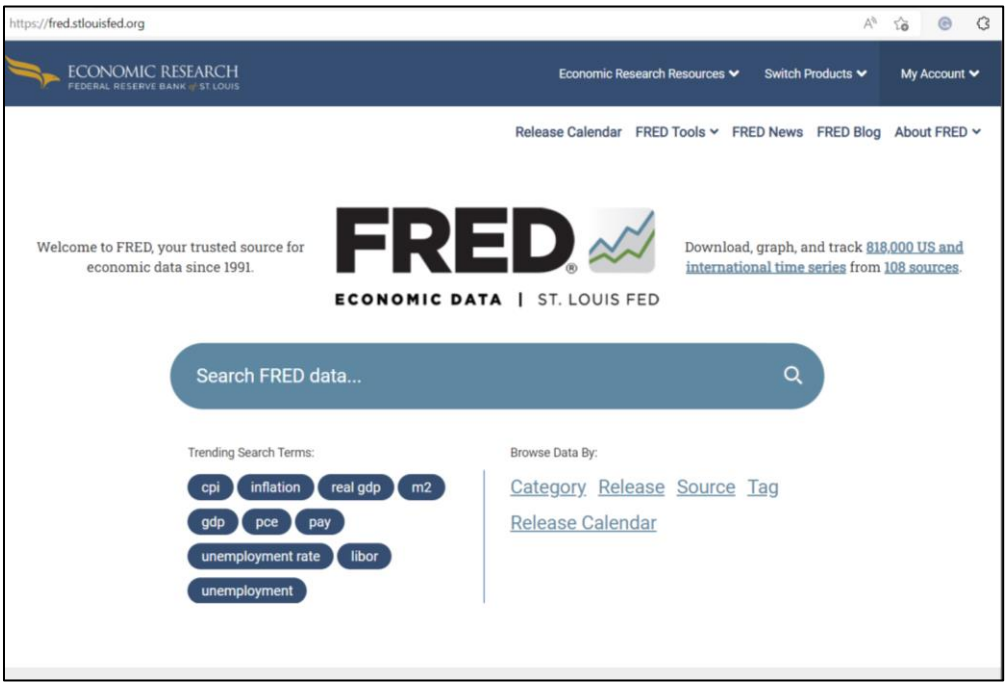
The activity begins with a presentation to review the main determinants of the price and income elasticity of demand. Then in pairs or small groups (depending on the class size), have students consider the following products: food away from home and alcoholic beverages. Specifically, they discuss how the demand for these products might have changed between 2000 and 2021. The faculty member should distinguish the effects of the Great Recession and the COVID-19 pandemic on demand for these goods. To facilitate this discussion, the instructor can utilize the pre-activity quiz outlined in Appendix A.

After reviewing concepts and completing the pre-activity quiz, students extract the price, income, and quantity data from FRED to calculate elasticities using EXCEL. The instructor should emphasize the need for price, income, and quantity data for elasticity calculation. The instructor is also encouraged to explain how the consumer price index (CPI), real disposable personal income per capita, and real personal consumption expenditure (PCE) quantity indexes could be used as proxies for price, income, and quantities in the elasticity formula. The instructor can use the following steps to demonstrate extracting data from FRED.

*How to extract data from FRED*

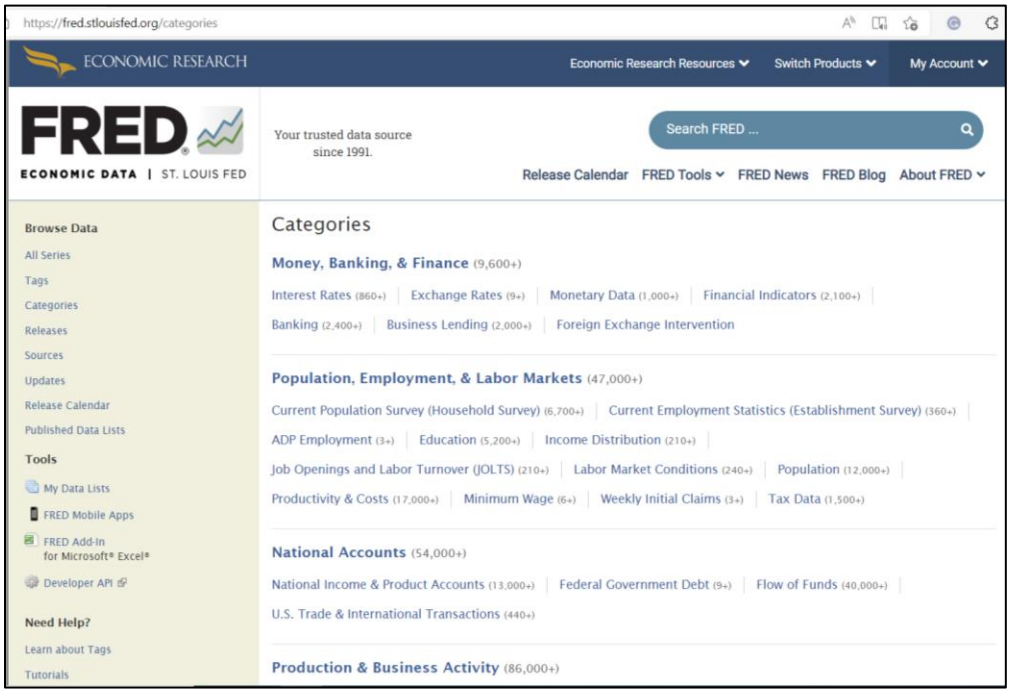
1. Go to https://fred.stlouisfed.org. It will look something like this:

**Figure 1.** The main page of the FRED website.




2. Click on the *Category* tab. It will look something like this:

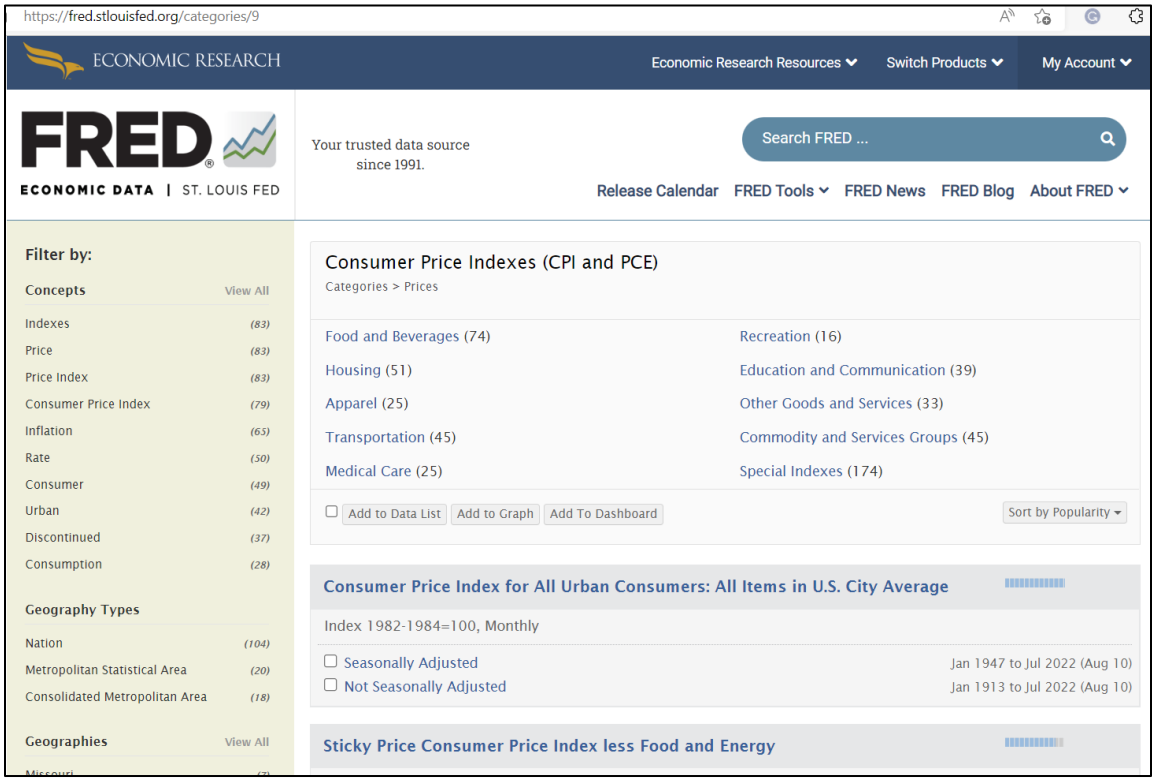
**Figure 2.** Data categories under the FRED.




The numbers in parentheses indicate how many data series are in each category. For example, the *Money, Banking, & Finance* category contains more than 9600 data series.

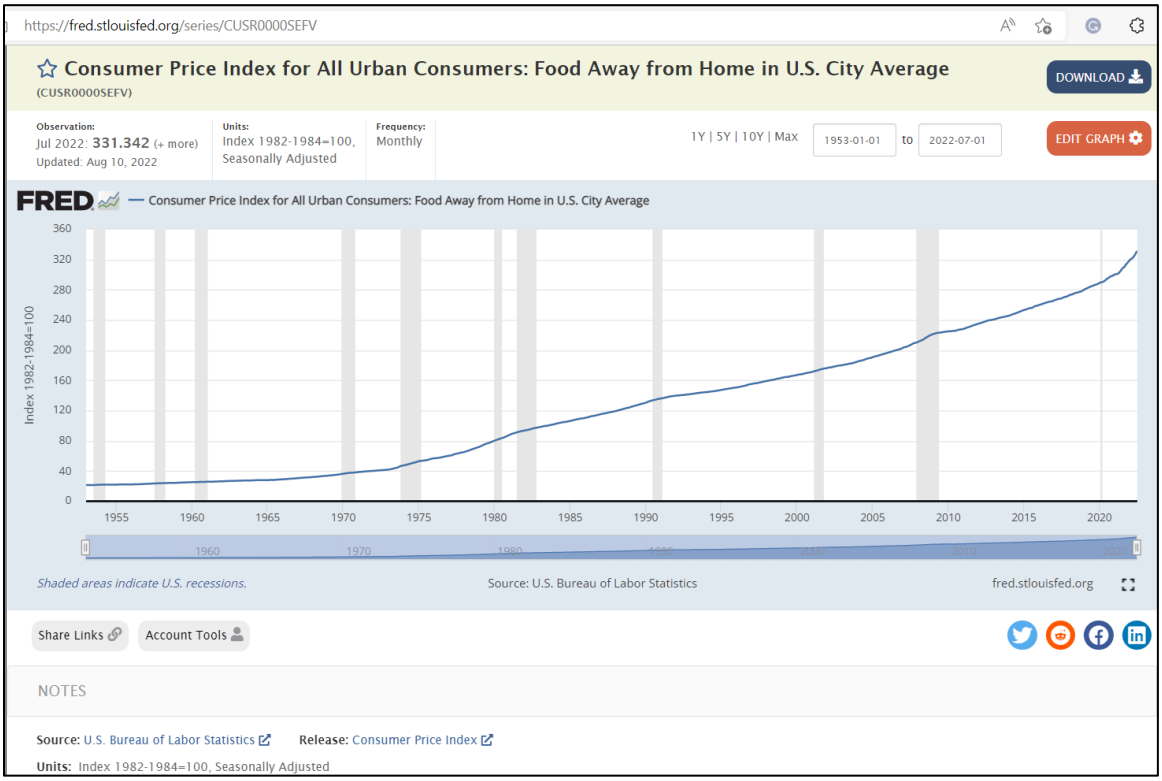
3. From the *Price* Category, select *Consumer Price Indexes (CPI and PCE)*. It will look something like this:

**Figure 3.** Consumer Price Indexes (CPI and PCE) on the FRED website.




To calculate the price and income elasticity of demand for food away from home (or alcoholic beverages), select the Food and Beverage sub-category and the series "Consumer Price Index for All Urban Consumer: Food Away from Home in U.S. City Average" (or "Consumer Price Index for All Urban Consumers: Alcoholic Beverages in U.S. City Average"). We used the seasonally adjusted data series. Click on it, and you will get a graph:

**Figure 4.** Line graph of the Consumer Price Index for All Urban Consumers: Food Away from home in the U.S. City Average




Observations from Figure 4:

- Above the graph, the ticker is displayed. In this case, it is CUSR0000SEFV. This is a "nickname" for this data series.
- Above the graph, the last available data point is shown under *Observation*. We are viewing monthly data displayed under *Frequency*. We can also adjust the timeframe highlighted in the graph
- Below the graph, in the middle, the student can see the data source (U.S. Bureau of Labor Statistics).
- Notice the gray bars. They indicate periods of economic recessions; the last gray bar highlights the COVID-19-induced economic downturn in 2020.
- There are several helpful features in the *Edit Graph* tab:
    - Under *Edit Line*, the student can edit the data series. Notice that students can choose the data frequency, such as monthly, quarterly, annually, etc. Notice that students can change the units.
    - Under *Add Line*, the student can add a data series to the graph, and we will use this option in the following steps.
    - Under *Format*, the student can edit the graph by changing the font, colors, etc.
- The *Download* tab allows the student to export the data in various formats. Students can also export the data in CSV or EXCEL format.

In the FRED search for "Consumer Price Index for All Urban Consumers: Food Away from Home in U.S. City Average," seasonally adjusted data.

4. Click on the *Edit Graph* tab in the top right corner.
5. Under Frequency, select "Annual."
6. *Add Line* tab (top middle button), type in "Real personal consumption expenditures: Services: Purchased meals and beverages (chain-type quantity index) or type DPMBRA3A086NBEA" and click on Add data series below it.
7. Similarly, under the *Add Line* tab, click "Real Disposable Personal Income: Per Capita" or type "A229RX0" and click on Add data series below it.
8. Adjust the date range as desired. We use annual averages for January 2000 to December 2021 (i.e., 2000-01-01 to 2021-12-01).
9. Click the download tab to export data. A sample of the data in EXCEL format is provided in Appendix B.

Repeat similar steps for alcoholic beverages and electricity.

*How to calculate and analyze price and income elasticity in EXCEL*

Once the data is extracted, students start calculating the elasticities associated with FAFH and alcoholic beverages using the necessary EXCEL formula (ideally from the formula discussed in earlier lectures). Like Méndez-Carbajo and Asarta (2017), we use the following equations to calculate the price and income elasticities of demand:

$$Price\ Elasticity\ of\ Demand = \frac{Midpoint\ Q_D}{Midpoint\ P} = \frac{\frac{Q_{Dt}-Q_{Dt-1}}{\frac{Q_{Dt}+Q_{Dt-1}}{2}}}{\frac{P_t-P_{t-1}}{\frac{P_t+P_{t-1}}{2}}} \quad (1)$$

where $Q$ represents quantity demand, and $P$ represents price. The variable $t$ accounts for time such that $Q_{Dt}$ measures quantity demanded during a particular year $t$, and $Q_{Dt-1}$ captures quantity demanded during the previous year, $t-1$.

Similarly, income elasticity may be calculated using the following formula:

$$Income\ Elasticity\ of\ Demand = \frac{Midpoint\ Q_D}{Midpoint\ I} = \frac{\frac{Q_{Dt}-Q_{Dt-1}}{\frac{Q_{Dt}+Q_{Dt-1}}{2}}}{\frac{I_t-I_{t-1}}{\frac{I_t+I_{t-1}}{2}}} \quad (2)$$

where $Q$ represents quantity demand, and $I$ represents income.

Tables 1 and 2 outline elasticity values for the selected years. In the next step, students plot line graphs and illustrate the year-over-year elasticity numbers. Finally, within their assigned group, students discuss their findings.

To highlight the recessions' impact on the price and income elasticities of demand, students plot the elasticity numbers with recessionary periods shaded (see Figures 5 and 6). To create these figures, students create a new variable called "Recessions" in their current EXCEL file. Under the Recessions column, for the Great Recession (2007-2009) and the COVID-19 pandemic (2020-2021), they will put numbers higher than the maximum elasticity value calculated; for example, students may use 10. The 'max' EXCEL function can be used to identify the largest value in a series.

Next, students will select the variables date, price elasticity of demand for FAFH and alcoholic beverages, and recessions. They will click "*insert*" tab and select line graph. Later, they will right-click the recessions series and change the chart format to the "area." In the final step, they will change the filling color. This way, when students plot a line graph, they will be able to see the impact of recessions clearly on consumer behavior.

After creating graphs, students will form groups, discuss their expectations, compare calculations, and examine whether their expectations were realized. To facilitate this discussion, the instructor can administer the post-activity quiz in Appendix A as students work in groups.

*Suggestions for additional discussion questions*

The instructor can extend the assignment by assigning the following questions for a group discussion:

1. Starting from January 2000, examine the price elasticity numbers and determine whether the goods you analyzed are elastic or inelastic over time.
2. How does the data analysis inform or change your understanding of elasticity?
3. What happens to the income elasticity numbers during recessions? The U.S. economy experienced two recessions during the sample period. Are the income elasticity numbers following a similar pattern?
4. Consider the beginning of COVID-19- especially during March and April 2020, when stay-at-home orders were in effect- discuss some of the changes made by the typical consumer. How can we use the elasticity numbers to explain these changes?

*Summary of findings*

Table 1 shows the price elasticity of demand for FAFH and alcoholic beverages in absolute value. Demand for FAFH is inelastic between 2000 and 2006. This suggests that relatively large increases in the price of FAFH result in relatively small decreases in quantity demanded quantity demand. During the Great Recession (2007-2009), consumers became more sensitive to price changes, and demand switched from price inelastic to elastic. As we expected, negative macroeconomic shocks decrease consumer confidence, partly explaining consumers' responsiveness to price changes. Specifically, the results outlined in Table 1 suggest that a 1% increase in the price of FAFH decreased the quantity demanded by 1.5% during the Great Recession.

**Table 1.** Price elasticity of demand for FAFH, alcoholic beverages, and electricity (in absolute value).

| | **Between 2000-2006** | **Great Recession (Between 2007-2009)** | **Between 2010-2019** | **COVID-19 Pandemic (Between 2020-2021)** |
|---|---|---|---|---|
| FAFH | 0.8651 | 1.5400 | 1.0291 | 4.2390 |
| Alcoholic Bev. | 1.0021 | 1.5292 | 1.8582 | 2.8802 |
| Electricity | 0.3021 | 0.7724 | 0.0833 | 0.3763 |

As the macroeconomy improved between 2010 and 2019, quantity demanded became less responsive to price changes (the price elasticity value falls from 1.5% to 1.0%). However, demand for FAFH remains price elastic. This observation may reflect a change in preferences associated with an increase in consumers' ability to substitute food prepared at home with FAFH. Similarly, during the COVID-19 pandemic, due to the lockdowns and COVID restrictions, consumer demand for FAFH became more responsive to price changes as the elasticity values rose to 4.2%. On the other hand, demand for alcoholic beverages is always price elastic, which suggests that relatively small increases in the price of alcoholic beverages result in relatively large decreases in the quantity demanded. As expected, the magnitude of the price elasticity values increases during economic recessions.

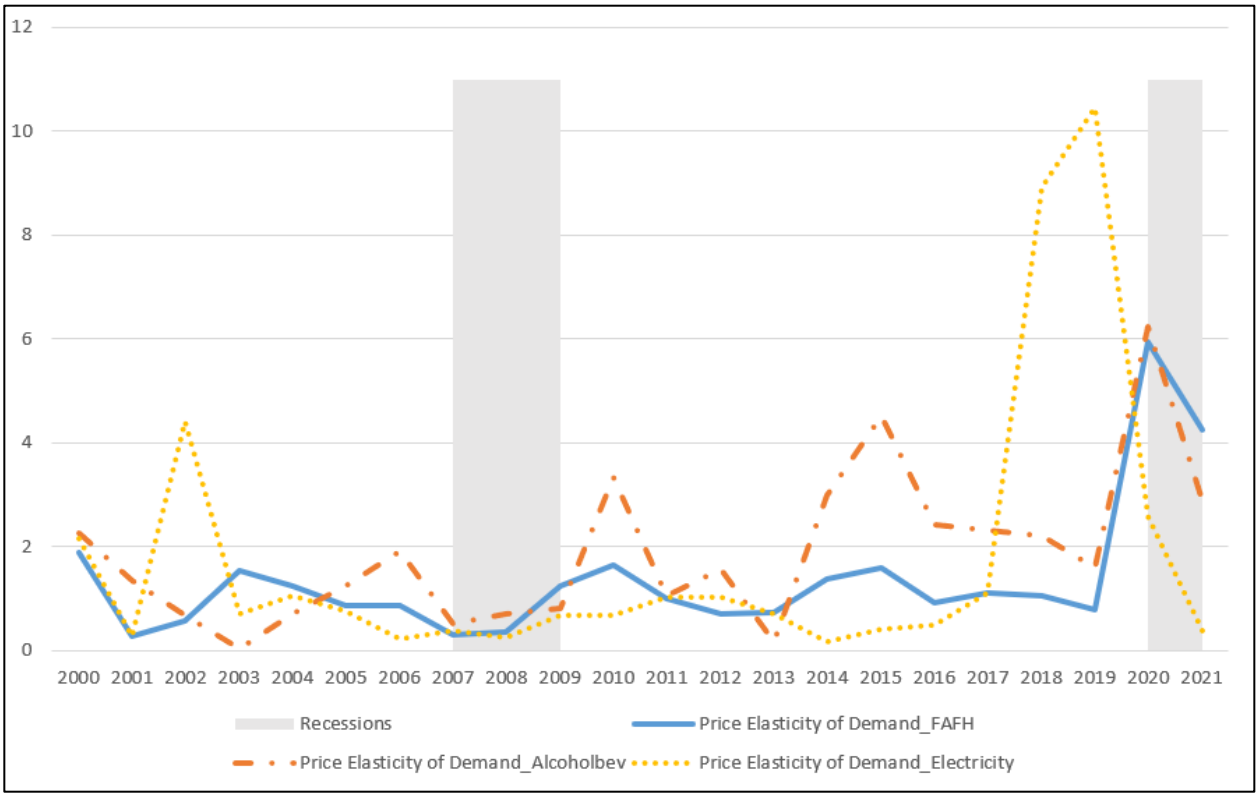
**Table 2.** Income elasticity of demand for FAFH, alcoholic beverages, and electricity.

| | **Between 2000-2006** | **Great Recession (Between 2007-2009)** | **Between 2010-2019** | **COVID-19 Pandemic (Between 2020-2021)** |
|---|---|---|---|---|
| FAFH | 1.3290 | 7.7325 | 1.5145 | 9.1575 |
| Alcoholic Bev. | 1.2621 | 6.5303 | 1.4883 | 2.9407 |
| Electricity | 0.7491 | 4.7525 | 0.0540 | 0.7565 |

We present the income elasticity of demand for FAFH, alcoholic beverages, and electricity in Table 2. A positive income elasticity value indicates a normal good, while a negative value indicates an inferior product. Based on the results presented in Table 3, all items are normal goods for the average U.S. consumer. However, FAFH and alcoholic beverages are luxury items, while electricity is a necessity.

During the Great Recession, when average disposable income declined, demand for all three items became more responsive to income shocks (i.e., the income elasticity values increased in magnitude) as consumers reduced demand. Between 2020 and 2021, disposable income increased by 2.1%. As a result, the positive income elasticity values reflect an increase in demand for these goods as income increases. Higher disposable income during the pandemic years is often not associated with economic downturns but is attributed to the brief recession in 2020 and the speedy economic recovery following aggressive fiscal and monetary policies. It is important to note that for alcoholic beverages and electricity, the income elasticity values during the COVID-19 pandemic were smaller than the values recorded during the Great Recession when disposable income decreased.[5]

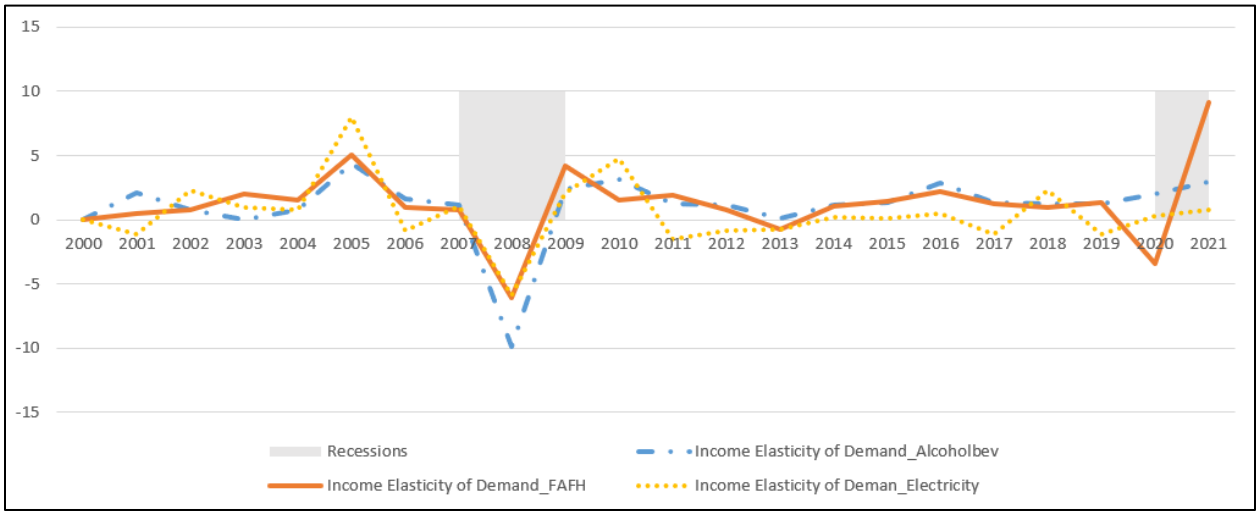
**Figure 5.** Price elasticity of demand for FAFH and alcoholic beverages[6]




[5] The larger income elasticity value associated with FAFH may be associated with the reopening of restaurants in 2021, which bolstered demand.

[6] The estimated price elasticity of demand values for 2010 and 2012 were higher than the sample average because of high demand. As a result, we replace these estimates with the previous year's value.

**Figure 6**. Income elasticity of demand for FAFH and Alcoholic beverages




## Pre/Post-In-Class Exercise

To enhance learning and provide a fruitful discussion, the instructor provides each student with two copies of a "pre/post-in-class activity" sheet at the beginning of the class.[7] Administering this quiz before and after the main assignment allows students to make predictions based on their elasticity knowledge from previous lectures and evaluate their understanding of the concept directly after completing the learning activity or assignment. This instructional method has received support from researchers such as Fanta and Boubacar (2016).

After the individual data preparation and download, students discuss what they observe in small groups and compare their responses using the "pre/post-in-class activity" sheet. We encourage group discussions because team learning may help students tackle more complex problems, share diverse perspectives, and develop greater communication skills (Caruso and Woolley, 2008; Mannix and Neale, 2005). In addition, group work creates more opportunities for critical thinking and can promote student learning and achievement. Since groups may approach and solve problems in interesting ways, this could be a refreshing approach for instructors.

## Conclusion

This paper presents an assignment for undergraduate Principles of Economics students. In the assignment, students work individually on the data preparation, elasticity calculations, and graphs; later, they form groups and discuss their observations. The assignment is designed to take one to two hours of instructional time so that it can be added to most undergraduate economics classes. Experience with spreadsheets and exposure to the array of functions in EXCEL are becoming necessary skills for most careers that economics or business graduates would pursue. The assignment outlined in this paper provides an opportunity for students to gain additional skills in EXCEL, increase their familiarity with accessing public datasets, and apply formulas to understand real-life examples and interpret data.

[7] Appendix A shows the Pre/Post-in-Class Activity in detail.

**References**


Acemoglu, D., Laibson, D. and J.A. List. 2021. *Microeconomics*. 3rd edition, Pearson.

Andrews, T., & Benzing, C. 2010. "Simplifying the price elasticity of demand." *Journal for Economic Educators,* 10(1):1-13.

Bade, R. and Parkin, M. 2020. *Foundations of Microeconomics*. 9th edition, Pearson.

Barreto, H. (2015). "Why excel?" *The Journal of Economic Education,* 46(3):300-309.

Briand, G. and Hill, R.C., 2013. "Teaching basic econometric concepts using Monte Carlo simulations in Excel." *International Review of Economics Education, 12*: 60-79.

Bongers, A., Gómez, T. and Torres, J.L., 2020. "Teaching dynamic general equilibrium macroeconomics to undergraduates using a spreadsheet." *International Review of Economics Education, 35*: 100197.

Bonwell, C.C. and Eison, J., 1991. "Active learning: creating excitement in the classroom. ASHEERIC Higher Education Report, 1, George Washington University School of Education and Human Development."

Bureau of Labor Statistics (BLS). 2022. "U.S. Department of Labor, The Economics Daily, Changes to consumer expenditures during the COVID-19 pandemic." <https://www.bls.gov/opub/ted/2022/changes-to-consumer-expenditures-during-the-covid-19-pandemic.htm>. Accessed 30 August 2022.

Caruso, H.M., & Wooley, A.W. 2008. "Harnessing the power of emergent interdependence to promote diverse team collaboration." *Diversity and Groups,* 11:245-266.

Centers for Disease Control and Prevention. 2022. "CDC Museum Covid-19 Timeline." *Centers for Disease Control and Prevention*. <https://www.cdc.gov/museum/timeline/covid19.html>. Accessed 4 September 2022.

Coppock, L. & Mateer, D. 2020. *Principles of Microeconomics*. 3rd edition, W. W. Norton & Company.

Fanta, F., & Boubacar, I. 2016. "Experiential vs. Lecture-based teaching: Does the choice of instructional method matter?" *Journal of Economics & Economic Education Research,* 17(3).

Formby, S. K., Medlin, D., & Ellington, V. B. 2017. "Microsoft Excel®: is it an important job skill for college graduates?" *Information Systems Education Journal,* 15(3), 55.

Ghosh, I., & Rahman, F. 2011. "Using current and up-to-date examples as a teaching tool in economics: a description." *Journal of Economics and Economic Education Research,* 12(1):1-9.

Hubbard, G. and O'Brien, A.P. 2020. *Microeconomics*. 8th edition, Pearson.

Lodge, J.M., Kenndey, G., Lockyer, L., Arguel, A., and Pachman, M. 2018. "Understanding Difficulties and Resulting Confusion in Learning: An Integrative Review." *Frontiers in Education,* 3:49.

Lusk, J. L., & McFadden, B. R. 2021. "Consumer food buying during a recession." *Choices,* 36(3):1-9.

Mannix, E., & Neale, M.A. 2005. "What differences make a difference? The promise and reality of diverse teams in organizations." *Psychological Science in the Public Interest,* 6(2):31-55.

Méndez-Carbajo, D., & Asarta, C. J. 2017. "Using FRED data to teach price elasticity of demand." *The Journal of Economic Education,* 48(3):176-185.

Mendez-Carbajo, D., Taylor, K. G., and Bayles, M. A. 2017. "Building a Taylor rule using FRED." *Journal of Economics Teaching,* 2(1):14–29.

Prince, M. 2004. "Does active learning work? A review of the research." *Journal of engineering education*, 93(3):223-231.

Saksena, M.J., A.M. Okrent, T.D. Anekwe, C. Cho, C. Dicken, A. Effland, H. Elitzak, J. Guthrie, K.S. Hamrick, J. Hyman, Y. Jo, B.-H. Lin, L. Mancino, P.W. McLaughlin, I. Rahkovsky, K. Ralston, T.A. Smith, H. Stewart, J. Todd, and C. Tuttle. 2018. "America's Eating Habits: Food Away from Home." *Washington, DC: U.S. Department of Agriculture, Economic Research Service, Economic Information Bulletin EIB-196.*

Salemi, M.K. 2002. "An Illustrated Case for Active Learning." *Southern Economic Journal*, 68(3):721-731.

Slater, J. 2018. "Teaching Price Elasticity of Demand." *Teaching Business & Economics,* 22(1):12-13.

Suiter, M. C., and Mendez-Carbajo, D. 2018. "FREDcast: Economic forecasting game." *The Journal of Economic Education,* 49(3):296.

Susskind, D., & Vines, D. 2020. "The economics of the COVID-19 pandemic: an assessment." *Oxford Review of Economic Policy*, 36(Supplement_1), S1-S13.

U.S. Bureau of Economic Analysis (BEA), 2022. Personal Income [PI], *FRED, Federal Reserve Bank of St. Louis*. <https://fred.stlouisfed.org/series/PI>. Accessed 30 August 2022.

Wei, J. S. 2013. "On Teaching Price Elasticity of Demand and Change in Revenue Due to Price Change-A Synthesis With and Without Calculus." *Forthcoming in International Journal of Business and Economics*, 12(1): 1-14.

Wolfe, M. 2020. "Integrating data analysis into an introductory macroeconomics course." *International Review of Economics and Education*, 33:100176.

Zhu, H., Wei, L. & Niu, P. 2020. "The novel coronavirus outbreak in Wuhan, China." *Global Health Research and Policy* 5, 6. <https://doi.org/10.1186/s41256-020-00135-6>. Accessed 4 September 2022.

## Appendix A

In this section, we provide the Pre/Post-in-Class Activity Sheet. The instructor is encouraged to administer this exercise before students extract and analyze data from FRED. Preferably distribute at the beginning of class so students can use their knowledge from previous lectures and/or personal experiences to complete the tables. After students download the data, calculate, and graph the elasticity numbers for each product, student groups should discuss their answers and go over their rationales. We recommend allotting five minutes to complete the activity sheet initially and eight to twelve minutes for the group comparison and discussion once the data analysis is complete.

**Pre/Post-in-Class Activity**

Complete the following tables by choosing the one alternative that best describes the product and provide at least one justification under the rationale column. Note that FAFH represents food away from home, such as restaurant meals.

Question 1. Price Elasticity

| **Product** | **Elastic** | **Inelastic** | **Unit Elastic** | **Reason/Rationale** |
|---|---|---|---|---|
| FAFH | | | | |
| Alcoholic Bev. | | | | |
| Electricity | | | | |

Question 2. Income elasticity

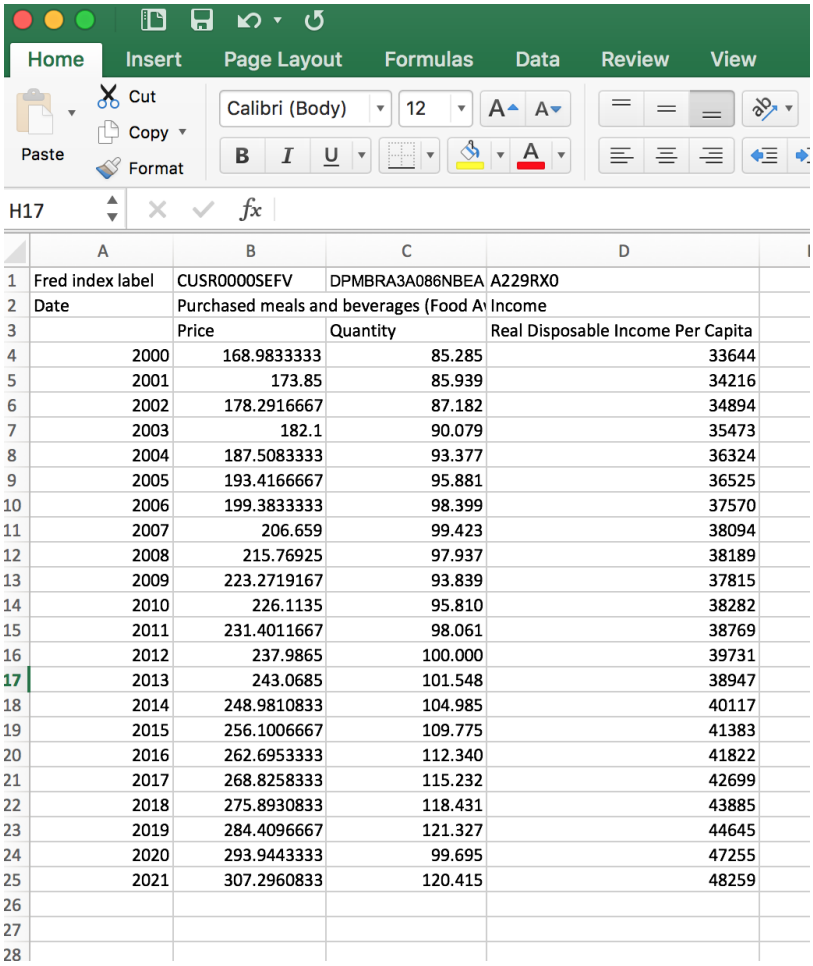
| **Product** | **Normal Good** | | **Inferior Good** | **Reason/Rationale** |
|---|---|---|---|---|
| | Luxury | Necessity | | |
| FAFH | | | | |
| Alcoholic Bev. | | | | |
| Electricity | | | | |

Question 3. As we move into a recessionary period (the Great Recession or COVID-19-induced recession), how would the magnitude of income elasticity of demand change?

| **Product** | **Increase** | **Decrease** | **No Change** | **Reason/Rationale** |
|---|---|---|---|---|
| FAFH | | | | |
| Alcoholic Bev | | | | |
| Electricity | | | | |

## Appendix B

In this section, we provide an example of the data structure extracted from FRED. In this example, we focus on food away from home.




| | A | B | C | D |
|---|---|---|---|---|
| 1 | Fred index label | CUSR0000SEFV | DPMBRA3A086NBEA | A229RX0 |
| 2 | Date | Purchased meals and beverages (Food A | | Income |
| 3 | | Price | Quantity | Real Disposable Income Per Capita |
| 4 | 2000 | 168.9833333 | 85.285 | 33644 |
| 5 | 2001 | 173.85 | 85.939 | 34216 |
| 6 | 2002 | 178.2916667 | 87.182 | 34894 |
| 7 | 2003 | 182.1 | 90.079 | 35473 |
| 8 | 2004 | 187.5083333 | 93.377 | 36324 |
| 9 | 2005 | 193.4166667 | 95.881 | 36525 |
| 10 | 2006 | 199.3833333 | 98.399 | 37570 |
| 11 | 2007 | 206.659 | 99.423 | 38094 |
| 12 | 2008 | 215.76925 | 97.937 | 38189 |
| 13 | 2009 | 223.2719167 | 93.839 | 37815 |
| 14 | 2010 | 226.1135 | 95.810 | 38282 |
| 15 | 2011 | 231.4011667 | 98.061 | 38769 |
| 16 | 2012 | 237.9865 | 100.000 | 39731 |
| 17 | 2013 | 243.0685 | 101.548 | 38947 |
| 18 | 2014 | 248.9810833 | 104.985 | 40117 |
| 19 | 2015 | 256.1006667 | 109.775 | 41383 |
| 20 | 2016 | 262.6953333 | 112.340 | 41822 |
| 21 | 2017 | 268.8258333 | 115.232 | 42699 |
| 22 | 2018 | 275.8930833 | 118.431 | 43885 |
| 23 | 2019 | 284.4096667 | 121.327 | 44645 |
| 24 | 2020 | 293.9443333 | 99.695 | 47255 |
| 25 | 2021 | 307.2960833 | 120.415 | 48259 |
| 26 | | | | |
| 27 | | | | |
| 28 | | | | |