

Homework 4 (32 Points)

Note. You should write this homework in **R Markdown** and include all codes that you have used to generate your results and graphs.

Problem 1 (12 Points)

Suppose your demand for a good – call it good 1 – is

$$q_1 = 1000 - 10p_1 + 5p_2 + 2I$$

, where p_1 is the price of good 1, p_2 is the price of a related good – call it good 2 – and I is your income.

1. Plot the relationship between p_1 and q_1 when $p_2 = 50$ and $I = 100$ ¹. (2 Points)
2. Plot the relationship between p_2 and q_1 when $p_1 = 50$ and $I = 100$ ². (2 Points)
3. Plot the relationship between I and q_1 when $p_1 = 50$ and $p_2 = 50$ ³. (2 Points)
4. In one plot, plot the relationship between p_1 and q_1 under the following 3 scenarios⁴: (2 Points)
 - (a) $p_2 = 50, I = 100$
 - (b) $p_2 = 10, I = 100$
 - (c) $p_2 = 50, I = 200$
5. Is good 1 a normal good or an inferior good to you? (2 Points)
6. Are good 1 and good 2 substitutes, complements, or neither? (2 Points)

¹For this question, draw p_1 on the x -axis and q_1 on the y -axis.

²For this question, draw p_2 on the x -axis and q_1 on the y -axis.

³For this question, draw I on the x -axis and q_1 on the y -axis.

⁴For this question, draw q_1 on the x -axis and p_1 on the y -axis.

Problem 2 (6 Points)

The [Consumer Expenditure Survey \(CE\)](#) is a quarterly survey of American households on their consumption pattern. The Diary Survey, which is a part of the Consumer Expenditure Survey, provides information on the type and amount of diary products that consumers buy. The file `CEdiary_201501.csv` contains data from the 2015Q1 Diary Survey^{5,6}. In this exercise, we use this data to look at the relationship between household income and total food expenditure.

1. Draw a scatter plot of household income and total food expenditure. (2 Points)

To do this,

- Use the variable `FINCBEFX` for household income.
- Use the variable `FOODTOT` for total food expenditure.
- Delete observations with zero or negative `FINCBEFX` or `FOODTOT`⁷.

2. Add a linear best-fit line to the scatter plot. (2 Points)
3. Based on this data, can you conclude whether food is a normal or an inferior good? (2 Points)

⁵You can access more public-use microdata from the Consumer Expenditure Survey [here](#).

⁶See [here](#) for a definition of data variables. See [here](#) for more information.

⁷This is because these are often missing values: for households that fail to answer survey questions about their income or food expenditure, the respective values are often coded at 0.

Problem 3 (14 Points)

Gasoline and Ethanol are both used as fuel for automobiles. Gasoline is derived from petroleum (crude oil). Corn is the main feedstock used for producing ethanol fuel in the U.S. In this exercise, we look at the relationship between the price of corn and crude oil. The **FRED** database at the Federal Reserve Bank of St. Louis contains data on **global corn prices**⁸ and **West Texas Intermediate (WTI) crude oil prices**^{9,10}.

1. Download *monthly* data on global corn prices and WTI crude oil prices from **Jan. 1986** to **Aug. 2016**. Plot the two time series together. (2 Points)
2. Describe the movement of corn price and crude oil price during this time period. (2 Points)
3. Draw a scatter plot of corn price vs. crude oil price. Add a linear best-fit line to the scatter plot. (2 Points)
4. What is the correlation between the price of corn and crude oil over this time period? (2 Points)
5. Based on the observed pattern in the data, do you think corn and crude oil are *more likely* to be substitutes, complements, or neither? (2 Points)
6. Other than corn and crude oil being substitutes or complements, are there any other explanations for the observed pattern in the data?¹¹ (2 Points)
7. What are the conditions that need to be satisfied for you to definitely conclude whether corn and crude oil are substitutes, complements, or neither? (2 Points)

⁸The FRED data on global corn prices are obtained from the **IMF database** on primary commodity prices.

⁹West Texas Intermediate (WTI), also known as Texas light sweet, is a grade of crude oil used as a benchmark in oil pricing.

¹⁰The FRED data on WTI crude oil **spot prices** are obtained from the **U.S. Energy Information Administration (EIA)**.

¹¹If your answer to question 5 is that corn and crude oil are substitutes because you think that explains the observed data, then this question asks you to imagine if there are any other possibilities in which these two goods are *not* substitutes that may also explain the observed data. Similarly, if you answer that corn and crude oil are complements, then this question asks you to imagine other possibilities.