Homework 6

Solutions

Problem 1 (8 Points)

Read the following two articles by Alesina, et. al.: "Why women should pay less tax," and "Gender-Based Taxation and the Division of Family Chores."

1. The authors propose to reduce income taxes on women and increase income taxes on men. They claim that it is possible to raise taxes on men by less than the reduction on women while also holding tax revenue constant. How is this possible? (2 Points)

   `Female labor supply is more elastic.`

2. Other than being "optimal" according to the Ramsey principle, what are other benefits of gender-based taxation according to the authors? Briefly summarize their arguments[1]. (2 Points)

   `reduce discrimination in hiring, change the traditional division of labour within the family in the long run`

3. Do you think gender-based taxation is a good idea? Why or why not? (4 Points)

[1] For example, the authors claim that gender-based taxation can help reduce discrimination in hiring. What is their argument?

Problem 2 (2 Points)

Read the article "Credit where taxes are due." According to this article, what are some of the negative unintended consequences of EITC?

`There is evidence that EITC increases the labor supply of single mothers, but decreases the labor supply of married women, as credits paid to men allow their wives to leave work. There is little evidence that EITC increases the labor supply of men.`

Problem 3 (4 Points)

Read and summarize the report "The Impact of US Tax Reform on Corporate Strategy and M&A."

Problem 4 (4 Points)

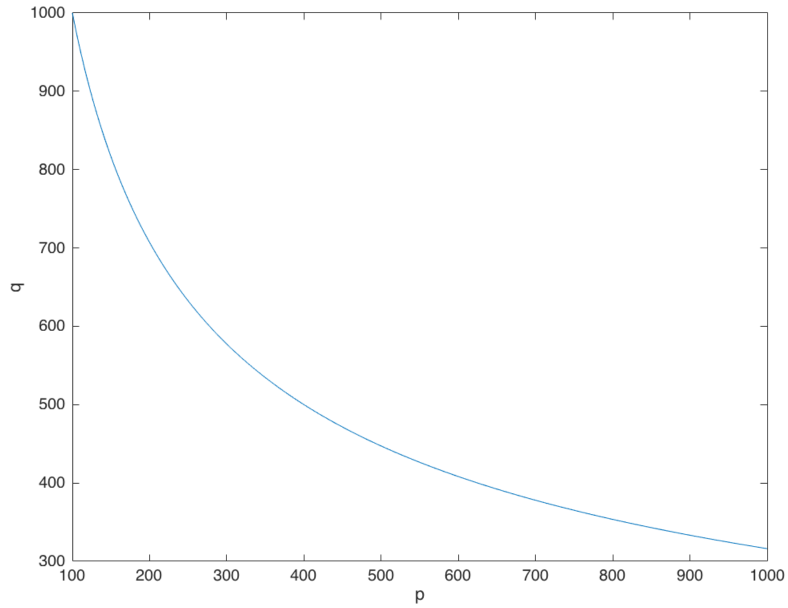
Read the articles "How Apple Sidesteps Billions in Taxes" and "How multinationals use Ireland to lower their tax bills." What do you think are some of the main problems and challenges caused by multinational firms' tax avoidance strategies to national governments and the global economy?

Problem 5 (12 Points)

Suppose the demand for a good is

$$q = \frac{10000}{\sqrt{p}} \tag{1}$$

1. Plot this demand curve[2]. (2 Points)



2. What is the price elasticity of demand for this good? (2 Points)

   `0.5`

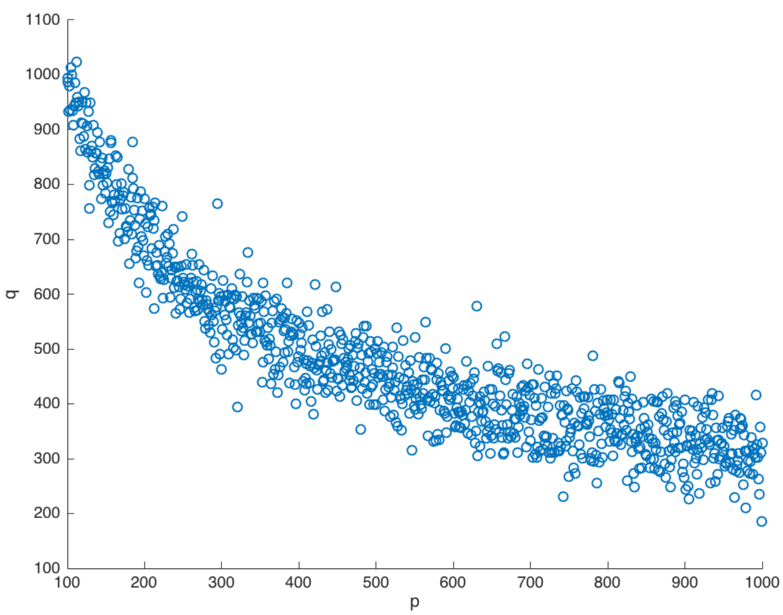
[2] For this question, draw p on the $x-$axis, q on the y–axis, and let p range from 100 to 1000.

In reality, the data we observe are often noisy. They may contain measurement error and unobserved variables. In the presence of measurement error, the relationship between observed prices and quantities can be represented by

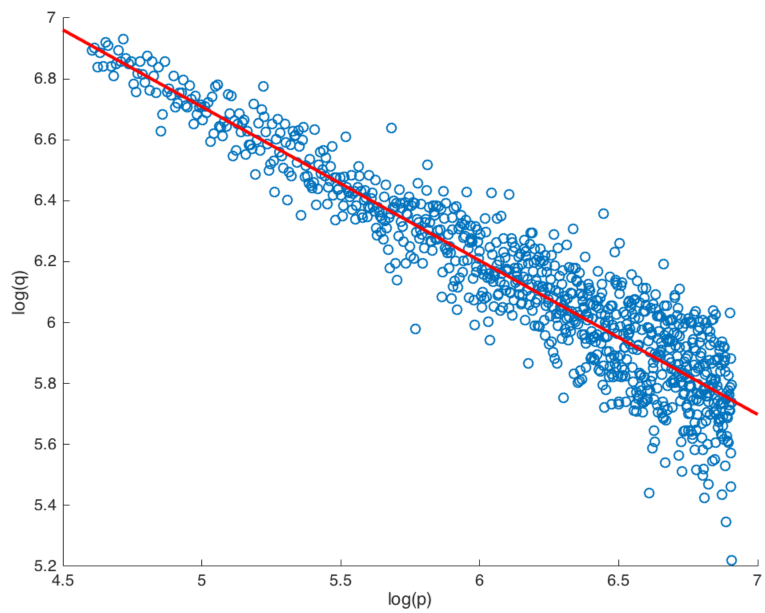
$$q = \frac{10000}{\sqrt{p}} + \epsilon \tag{2}$$

, where ϵ is random noise. "`Demand_data.csv`" contains data generated from (2). Use the data to answer the following questions:

3. Draw a scatter plot of p and q. (2 Points)



4. Draw a scatter plot of $\log(p)$ vs. $\log(q)$ and add a linear best-fit line. (2 Points)



5. Find out the slope of the linear best-fit line by regressing $\log(q)$ on $\log(p)$. (2 Points)
   `-0.5`

6. How does your answer to question 5 compare with your answer to question 2? Why? (2 Points)
   `They are equal (in absolute value). This is because` $\epsilon_{d,p} = \left|\frac{dq/q}{dp/p}\right| = \left|\frac{d(\ln q)}{d(\ln p)}\right|$.

   Remark. `Remember the price elasticity of demand, by definition, measures the relationship between percentage change in` p `and percentage change in` q[3]. `This is exactly what a scatter plot of` $\log(p)$ `and` $\log(q)$ `shows us. This is because for small` r `(`$|r| \ll 1$`),` $\log(1+r) \approx r$[4]. `Therefore, given a small percentage change in` p`, say` p `changes from` p `to` $p(1+r)$[5], $\frac{p(1+r)-p}{p} = r \approx \log(1+r) = \log(p(1+r)) - \log(p)$. `Therefore, the scatter plot of` $\log(p)$ `and` $\log(q)$ `shows us the relationship between percentage change in` p `and percentage change in` q. `Assuming that all data lie on the same demand curve, then (the absolute value of) the slope in the plot of` $\log(p)$ `vs.` $\log(q)$ `is by definition the price elasticity of demand.`

[3]i.e., given, say, a 1% increase in p, how much will q change in percentage terms?
[4]By Taylor expansion, $\log(1+x) = x - \frac{1}{2}x^2 + \frac{1}{3}x^3 \ldots \approx x$ for small x.
[5]say, $r = 0.01$: a 1% increase.

Problem 6 (22 Points)

The Laffer curve, named after Economist Arthur Laffer, is a representation of the theoretical relationship between rates of taxation and the resulting levels of government revenue. In this exercise, we derive the Laffer curve for a hypothetical labor market. Suppose the labor market is described by the following supply and demand equations:

$$\begin{aligned} \text{Supply: } Q_S &= 2W \\ \text{Demand: } Q_D &= 100 - 8W \end{aligned}$$

, where W denotes hourly wage, Q_S is the quantity of labor supplied (in hours), and Q_D is the quantity of labor demanded (in hours).

1. What are the equilibrium wage and hours of employment in this market? (2 Points)

   $W = 10, Q = 20$

2. Now suppose we impose an ad-valorem wage tax $\tau \in (0,1)$ on the workers. Let W^b denote the wage workers receive before paying tax to the government, and let W^f denote the wage after paying tax[6]. Solve for equilibrium W^b and W^f as a function of τ. (2 Points)

$$Q_S = 2W^f \tag{3}$$

$$Q_D = 100 - 8W^b \tag{4}$$

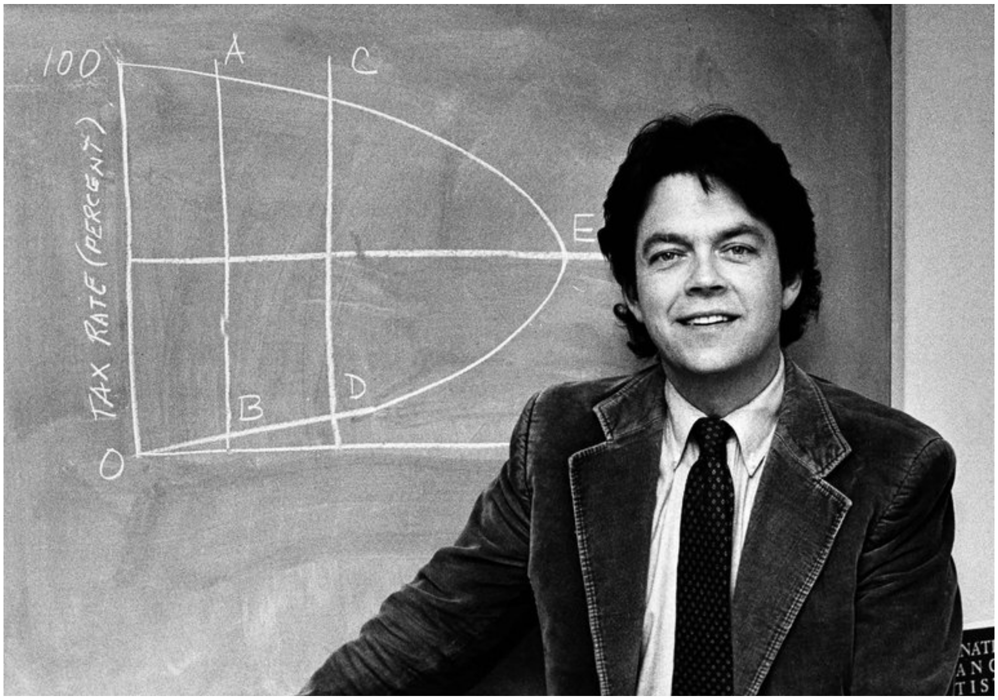
$$W^f = W^b(1-\tau) \tag{5}$$

$\Rightarrow$

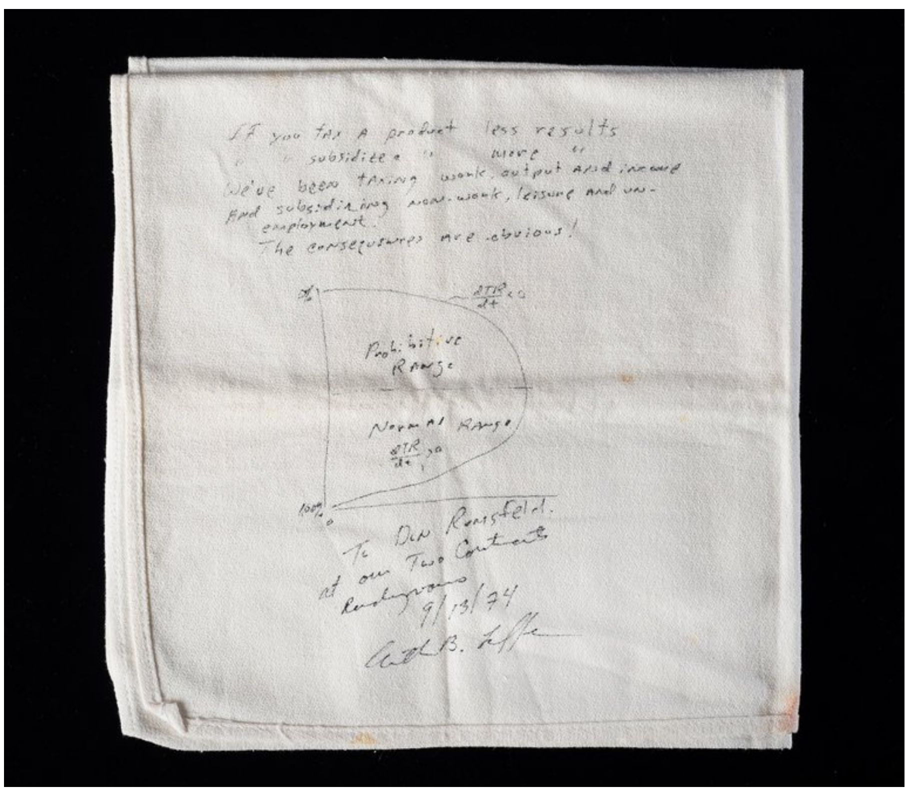
$$W^b = \frac{50}{5-\tau}$$

$$W^f = \frac{(1-\tau)\,50}{5-\tau}$$

[6] For example, suppose $\tau = 0.1$ (a 10% tax rate), then $W^f = (1-\tau)W^b = 0.9W^b$.

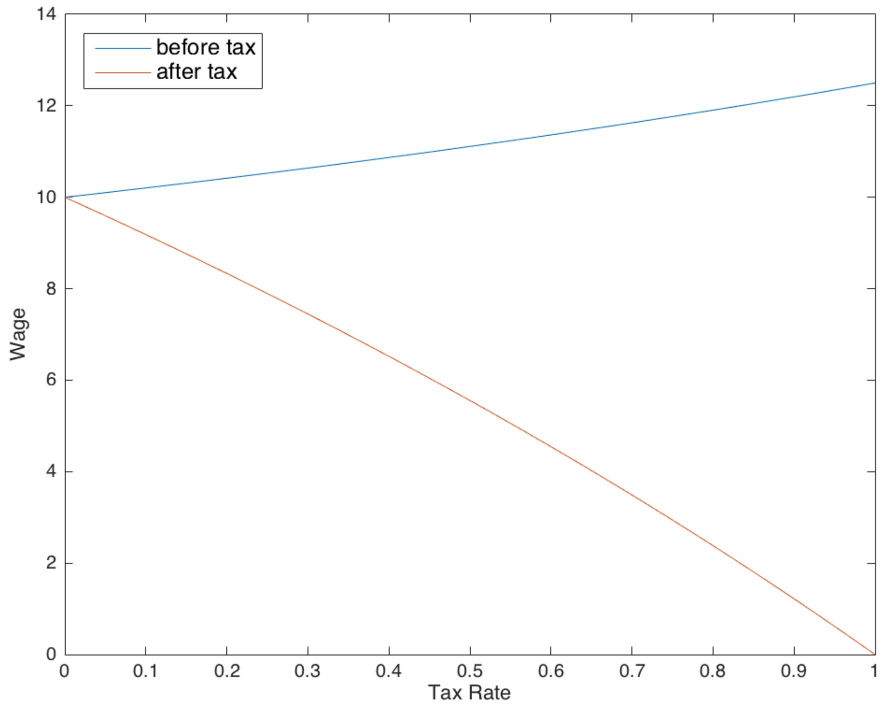


Arthur Laffer in 1981



The Laffer Curve napkin is on display at the National Museum of American History . For the story behind it, read this article.

3. In the same graph, plot the relationship between τ and W^b, and the relationship between τ and W^f[7]. (2 Points)



4. Solve for tax revenue as a function of τ. (2 Points)

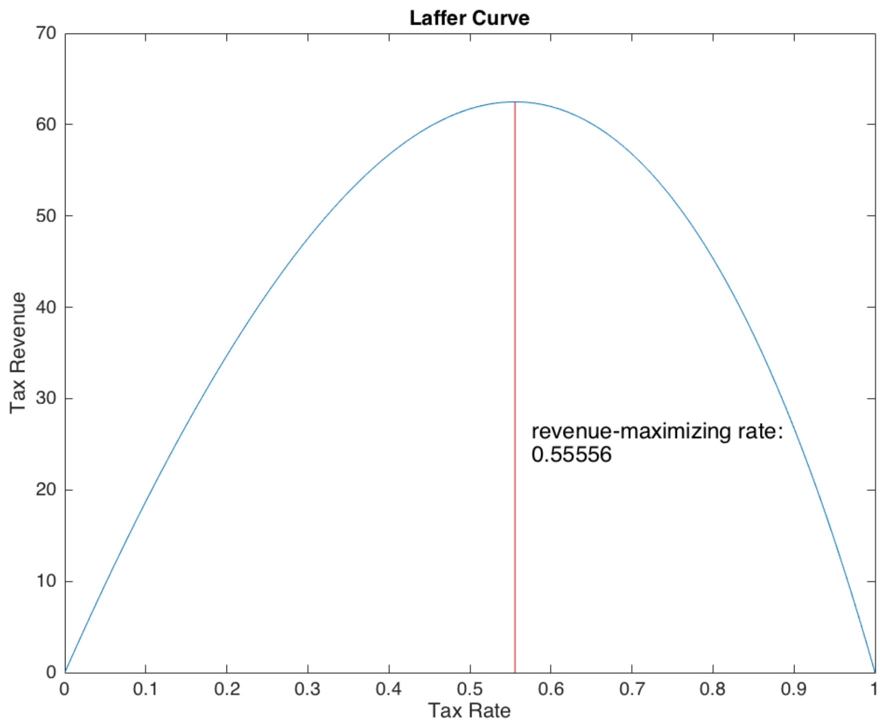
$$Q = \frac{(1-\tau)\,100}{5-\tau}$$

$$TR = \tau W^b Q = \frac{\tau\,(1-\tau)\,5000}{(5-\tau)^2}$$

`, where` TR `denotes tax revenue.`

[7] For this question and question 5 and 8, plot τ on the horizontal axis.

5. Plot the relationship between the tax rate τ and tax revenue – This is the Laffer curve. (2 Points)



6. Let τ^* denote the tax rate at which tax revenue is maximized. Calculate τ^*. (2 Points)

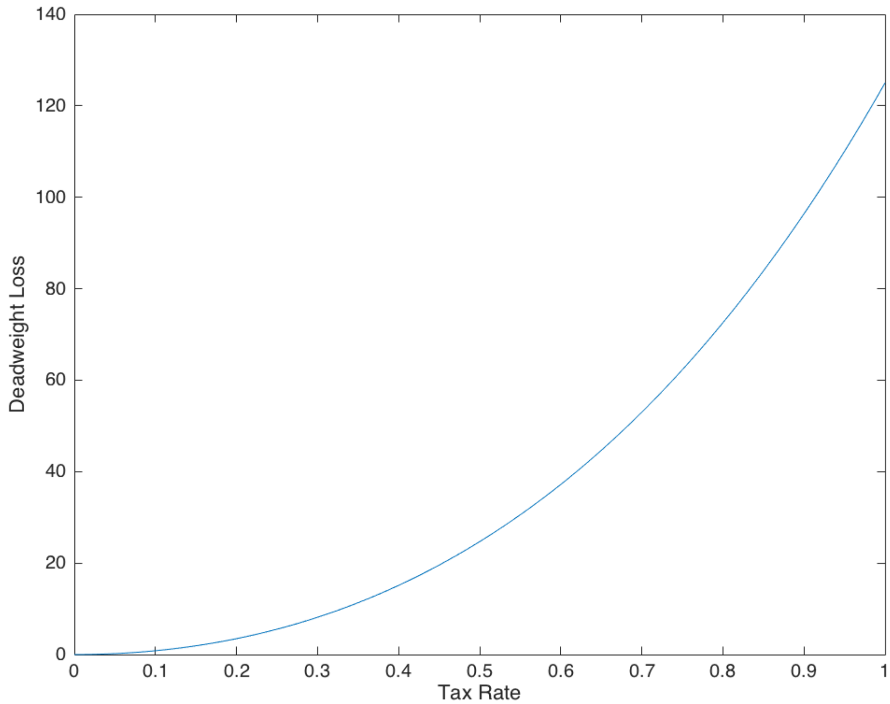
$$\left.\frac{dTR}{d\tau}\right|_{\tau=\tau^*} = 0 \Rightarrow \tau^* = \frac{5}{9}$$

7. Solve for deadweight loss as a function of τ. (2 Points)

$$\begin{aligned} DWL &= \frac{1}{2}\left(W^b - W^f\right)(20 - Q) \\ &= \frac{2000\tau^2}{(5-\tau)^2} \end{aligned}$$

, where 20 is the equilibrium quantity of labor supply before the wage tax is imposed.

8. Plot the relationship between τ and deadweight loss. (2 Points)



The Laffer curve shows that at high tax rates ($\tau > \tau^*$), cutting tax can lead to higher tax revenue. Some people, such as Laffer himself, have therefore advocated cutting U.S. income taxes for many years, believing that U.S. income taxes have always been too high and that cutting income taxes can lead to more, not less, government revenue. This is sometimes called the Laffer Hypothesis. Most economists, however, disagree[8].

In this exercise, let us look at what happened to U.S. government revenue after two of the largest tax cuts in recent U.S. history: (a) The Economic Recovery Tax Act of 1981 (ERTA), a.k.a. the 1981 Reagan tax cut, which, among other things, reduced top marginal income tax rate from 70% to 50%; and (b) The Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA), a.k.a. the 2001 Bush tax cut, which, among other things, reduced top marginal rate from 39.6% to 35%[9].

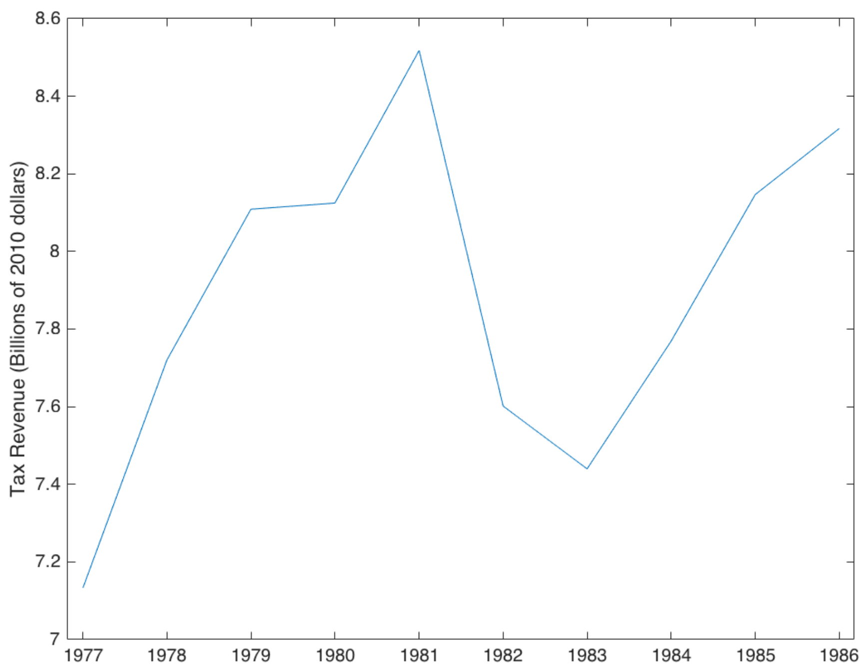
[8] See responses to Question B in the linked article. David Autor, for example, responds: "Not aware of any evidence in recent history where tax cuts actually raise revenue."

[9] Reagan himself believed in the Laffer Hypothesis. Here is what he said before signing the ERTA:

> "...our kind of tax cut will so stimulate the economy that we will actually increase government revenues..." July 7, 1981 speech.

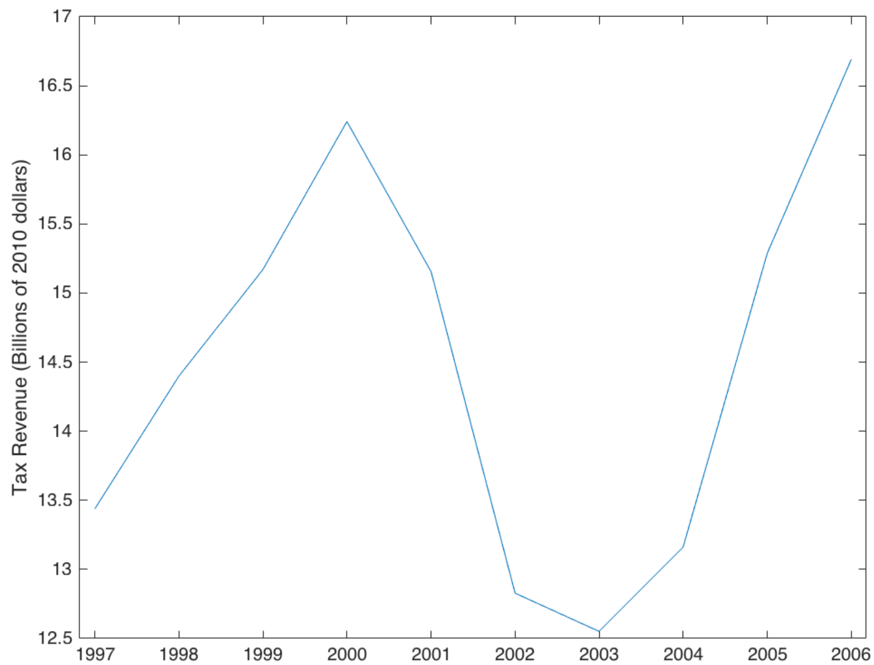
The FRED database at the Federal Reserve Bank of St. Louis contains data on federal government tax receipts. To look at the impact of the 1981 Reagan tax cut, we look at government tax receipts from 1977 to 1986. To look at the impact of the 2001 Bush tax cut, we look at government tax receipts from 1997 to 2006. To adjustment for inflation, divide tax receipts by the GDP Implicit Price Deflator[10]. We will call tax receipts that are not adjusted for inflation "*nominal* tax receipts," and those that have been adjusted for inflation "*real* tax receipts."

9. Plot *real* U.S. government tax receipts from 1977 to 1986. What does the data suggest about the effect of the 1981 Reagan tax cut on government revenue? (2 Points)



[10]We will talk about inflation and how to adjust for it later in this course. For now, you can just assume that by dividing tax revenue by the GDP deflator, we are able to "get rid of" inflation, which allows us to better compare tax revenues in different time periods.

10. Plot *real* U.S. government tax receipts from 1997 to 2006. What does the data suggest about the effect of the 2001 Bush tax cut on government revenue? (2 Points)



11. Do the experiences of these two major tax cuts validate the Laffer Hypothesis[11]? (2 Points)

    `No.`

[11] Our analysis here is of course not rigorous – many things other than tax cuts happened during those years. A careful analysis needs to parcel out the effects of various causes. For more rigorous analysis of the revenue impact of major tax cuts in U.S. history, see the literature summarized here.