

## Problem 5 (29 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:

$$\text{Supply: } Q_S = 2W$$

$$\text{Demand: } Q_D = 100 - 8W$$

, 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. What are the demand and supply equations after this tax? (2 Points)

$$Q_S = 2W^f \tag{5}$$

$$Q_D = 100 - 8W^b \tag{6}$$

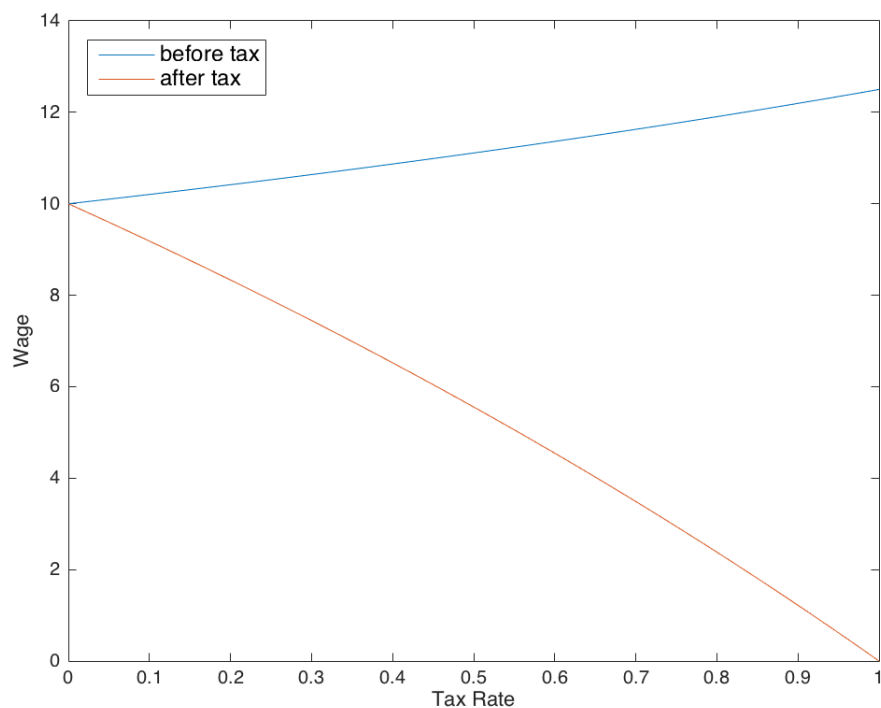
$$W^f = W^b(1 - \tau) \tag{7}$$

3. Let  $W^b$  denote before-tax wage and let  $W^f$  denote after-tax wage. Solve for  $W^b$  and  $W^f$  as a function of  $\tau$ . (2 Points)

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

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

4. In the same graph, plot the relationship between  $\tau$  and  $W^b$ , and the relationship between  $\tau$  and  $W^f$ . (2 Points)



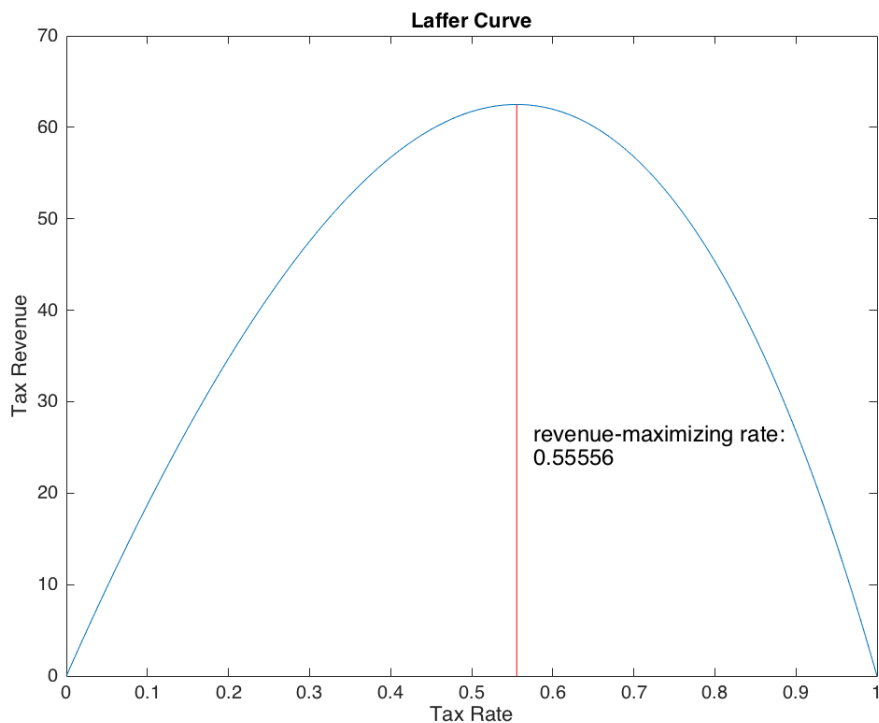
5. Solve for tax revenue as a function of  $\tau$ . (2 Points)

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

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

, where  $TR$  denotes tax revenue.

6. Plot the relationship between the tax rate  $\tau$  and tax revenue – This is the Laffer curve. (2 Points)



7. Let  $\tau^*$  denote the tax rate at which tax revenue is maximized. Calculate  $\tau^*$ . (2 Points)

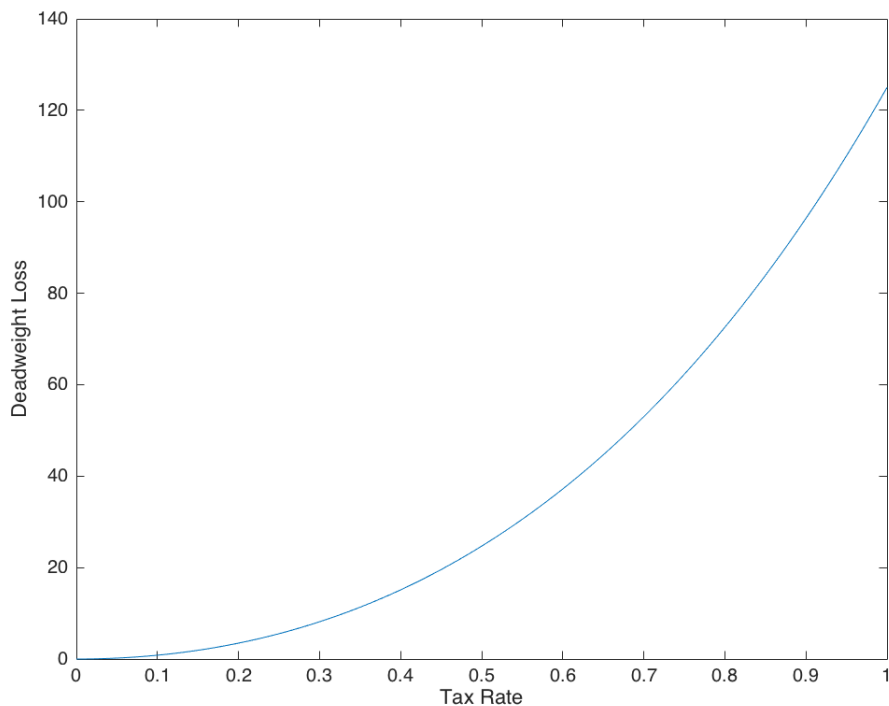
$$\left. \frac{dTR}{d\tau} \right|_{\tau=\tau^*} = 0 \Rightarrow \tau^* = \frac{5}{9}$$

8. Solve for deadweight loss as a function of  $\tau$ . (2 Points)

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

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

9. Plot the relationship between  $\tau$  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<sup>4</sup>.

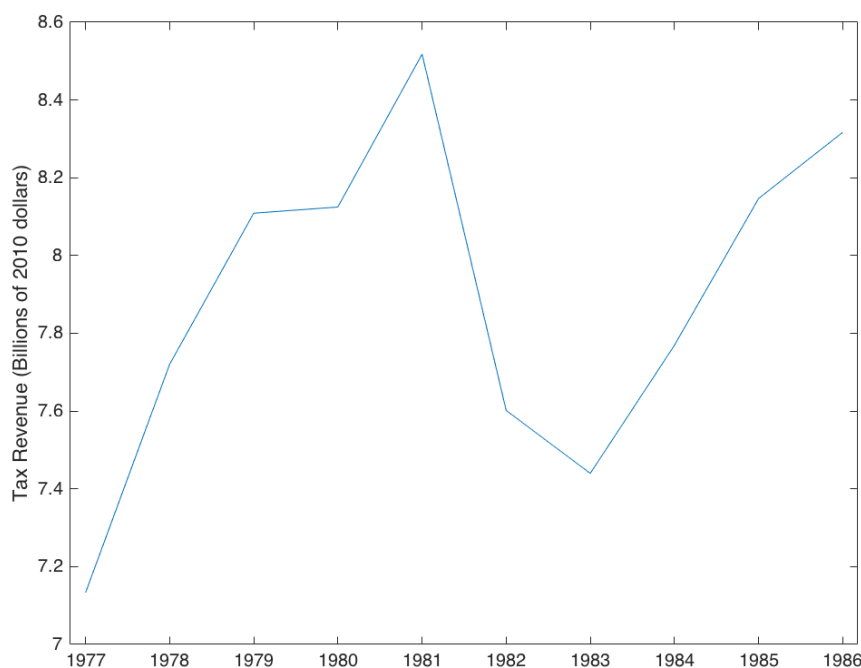
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<sup>4</sup>See responses to Question B. David Autor, for example, responds: “Not aware of any evidence in recent history where tax cuts actually raise revenue.”

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%<sup>5</sup>.

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 adjust for inflation, divide tax receipts by **the GDP Implicit Price Deflator**. 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.”

10. 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)

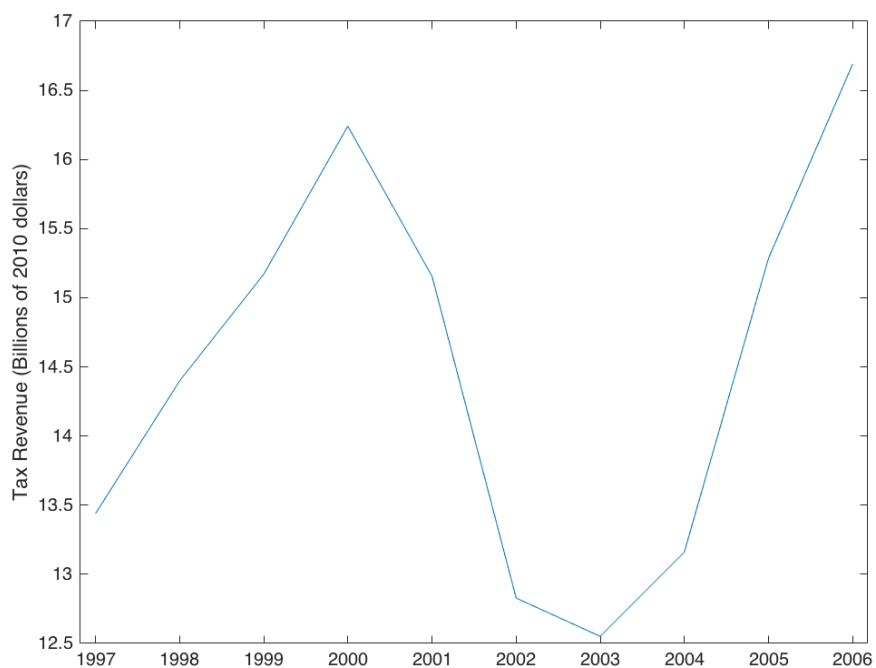



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<sup>5</sup>Reagan himself believed in the Laffer Hypothesis. Here is what he said before signing the ERTA:

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

11. 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)



12. Do the experiences of these two major tax cuts validate the Laffer Hypothesis<sup>6</sup>? (2 Points)

No.

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<sup>6</sup>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 [here](#) and the literature listed [here](#) (page 7–9).