1. Suppose both demand and supply are linear, $q_D = a - b\,p$ and $q_S = c + d\,p$. A quantity tax is a tax that has a constant value for every unit bought or sold. Determine the new equilibrium supply price p_S and demand price p_D when a quantity tax of amount t is applied.

2. An *ad valorem* tax is a proportional tax on value, like a sales tax. Repeat the previous exercise for an *ad valorem* tax t.

3. Let supply be given by $p = q$ and demand $p = 1 - q$. Suppose a quantity tax of 0.10 is applied.
    a. What is the change in quantity traded?
    b. Compute the tax revenue and dead weight loss.

4. Imagine that many students are bothered by loud music playing at 7am near their dorm. Using economic analysis, how would you improve the situation?

5. A local community uses revenue from its property taxes to build an expressway. Explain how this could give rise to free-riders and how to solve the free-rider problem.

6. In experiment 3.1, did addicts pay more than casual users? Why?

7. Draw the supply and demand for experiment 3.2. Compare the actual and predicted price and quantity.

8. When the police resell the confiscated units, what must happen to the number of units brought to market by sellers? Draw the demand and supply for experiment 3.4 and compare the predicted price and quantity.

9. Which provides for a higher social surplus in equilibrium, not counting the earnings of the police – experiment 3.2 or experiment 3.4? You need not use the actual data to answer this question.

Suppose both demand and supply are linear, $q_D = a - b\,p$ and $q_S = c + d\,p$. A quantity tax is a tax that has a constant value for every unit bought or sold. Determine the new equilibrium supply price p_S and demand price p_D when a quantity tax of amount t is applied.

Note that with application of the tax equilibrium requires that

$$a - bp_D = c + dp_S$$

and the quantity tax can be expressed as: $p_D = p_S + t$.

Upon substitution we arrive at

$$p_S = \frac{a - c - bt}{d + b}$$

$$p_D = p_S + t = \frac{a - c + dt}{d + b}$$

10. An *ad valorem* tax is a proportional tax on value, like a sales tax. Repeat the previous exercise for an *ad valorem* tax t.

The relation that changes from the previous exercise is now, $p_D = p_S(1 + t)$

We still have $a - bp_D = c + dp_S$ so upon substitution we arrive at

$$p_S = \frac{a - c}{d + b + bt}$$

$$p_D = p_S(1 + t) = \frac{(a - c)(1 + t)}{d + b + bt}$$

11. Let supply be given by $p = q$ and demand $p = 1 - q$. Suppose a quantity tax of 0.10 is applied.
   a. What is the change in quantity traded?
   b. Compute the tax revenue and dead weight loss.

Quantity decreases by 0.05 and the tax revenue is 0.045, dead weight loss is 0.025.

12. Imagine that many students are bothered by loud music playing at 7am near their dorm. Using economic analysis, how would you improve the situation?

The music is creating a negative externality. There are many way to deal with this problem, including rules about noise, taxes on the band, and subsidies to the residents of the house where the music is playing.

13. A local community uses revenue from its property taxes to build an expressway. Explain how this could give rise to free-riders and how to solve the free-rider problem.

People from neighboring towns who use the expressway and do not pay the property taxes are free-riders. This problem can be solved by establishing a toll booth.